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CENTRAL STATION BUSINESS.

Several central stations have been very cleverly advertising electricity as the only necessity of modern life that has actually decreased in price within recent years. It is true, and central station men may well be proud of it, that the economies of large production and wise administration have rendered it possible to bring down the price of electrical service to a figure that has greatly extended the demand. But in how far has it yet come into the position of a necessity in the larger sense of the word? Surely the modern world would find it hard to get along without electric lamps and motors, and the modern city would look queer if deprived of them. In spite of this there is a long way yet to go before the use of electricity in these ways is as widespread and as vitally connected with the life of the people as is for instance the telephone—to make comparison with another modern convenience. Go into any one of our larger cities and you will find in spite of good service and much missionary work, that electric lamps are used in a relatively small proportion of dwellings and electric motors in a minority of small establishments. The mansions and the great industrial establishments, like the great stores, use electricity very freely and the streets are aglow with electric signs, yet all over the city block after block will be found into which electric service has not yet made its way. This lack of universality is fully apprehended, as witness the very skilful and successful methods of business-getting to which much attention has been given in our columns. But this is not the vital point of the matter. Only when the need of a thing touches at once a very large proportion of people is its loss felt keenly and permanently. The great need in central station work is to bring the product into exactly this relation to the public.

Much of the recent new business does not meet this requirement. If every electric sign in this or any city were destroyed to-day it would be a forty-eight hours' wonder and people in a few weeks would be talking about the queer look the city used to have at night when the business streets reproduced in light the display advertising columns of newspapers. We believe that the energy of the new business department should be turned more vigorously toward general domestic lighting and the needs of the average small consumer. A street with electric lamps in every house is a more effective permanent advertisement than the biggest electric sign in town—and one, moreover, that precious few electric companies can show. Save in some Western small cities the proportion of human habitations lighted by electricity is surprisingly small. The same is true of small shops and factories. Until this condition can be changed electricity will lack that universal touch with mankind that ranks it as a necessity, and it will lack too the stability of demand that comes from that condition. The policy of leaving the small consumer to the gas company will sooner or later act as a boomerang. Some central station managers say the small user

does not pay and is not worth bothering with, but the fact remains that the gas companies thrive upon his patronage. Their rates favor him instead of hitting him hard, a fact which he does not forget when public favors are being asked.

Telephone Wire Plant.

The paper on "The Telephone Wire Plant" read by Mr. Sergius P. Grace before the recent meeting of the American Institute of Electrical Engineers is a welcome addition to the literature of telephony, if only for the reason that so little on this important aspect of telephone engineering has been brought before the American Institute of Electrical Engineers, or the technical press. Those who are not directly engaged in telephone engineering are apt to think at once of the central telephone stations and of their switchboards as the principal altars of expense in furnishing communication to the community; but, as the paper points out, about seventy per cent of the expense in plant is out of doors, and only thirty per cent is in the exchanges and in subscribers' sets. A salient characteristic of modern engineering and applied science, is its prevision of, and provision for, the future. The nautical almanac is computed six years ahead. The layout of large plants for the city railroads, lighting, gas, and water-distributing plants, are supposed to be laid out for at least ten years' growth, although, as a matter of fact, such plants are frequently no sooner completely installed than, like New York restaurants, they are overcrowded. The paper shows that telephonic distribution plants should be laid out with a view to conditions fifteen to twenty years ahead, and this is actually and systematically done in the case of at least one large city system.

It is interesting to observe that, as in prospecting for future electric lighting, so in preparing estimates for future telephoning, careful observations and counts have to be made of the buildings existing throughout the district, together with the judgment of skilled real-estate business men as to the expected rate of growth. Probable new railroad facilities, sociological and trade tendencies, even international or world influences, enter into such estimates, and affect the layout of the plant. It is not an exaggeration to say that, in a certain sense, and to a certain minute degree, the position of a well selected central telephone station, and the layout of a carefully designed telephone plant in some American city depends on the forecaster's estimate of certain international trade movements, into which countries like Australia, China or Siberia, enter. Nevertheless, after the best skill and foresight have been consulted, the layout of to-day may have to be materially modified to-morrow, by reason of the discovery of new agents and principles, or the introduction of wholly unforeseen and adventitious influences. No man can foresee earthquakes, conflagrations, Tammany Halls or discoveries like that of X-rays. The forecast of telephonic growth in the hands of the community, as laid down in the paper, is that the ratio of connected telephones to population will ultimately be between 15 and 30 per cent. At the present, it is believed to be less than 7 per cent. If then we take the mean forecast as 22 per cent, it represents about three times as many telephones per unit of population as are found in the country to-day. This would be a very large increase. After deducting the entire list of the poor who could never expect to rent a telephone, it would mean that each competent family would rent on the average at least two telephones. This would not be impossible, because, not counting clubs, public buildings and general offices, each householder would have one telephone at his office and one at his residence. Nevertheless, the estimate seems remotely high and not likely to be verified in the next generation.

Another noteworthy, although clearly determined, fact is that the unit of measure of telephonic growth is the telephone line-circuit or pair of line-wires, and not the number of connected telephones. The size of the cables, of the switchboard, and of the central-station plant, all depend intimately upon the number of line-circuits provided; whereas the number of telephones connected is necessarily a more variable quantity, depending upon the extent to which party-line service has been carried. Incidentally, it appears that the paper estimates one city office or station to about 5000 line circuits. The position of a central telephone station in a city district of full building development is theoretically determined by the map of the streets in that district, when questions of real estate valuation are excluded. In other words, if we construct a map of the district streets, and mark off on it the number and positions of telephones to each of which a line must be run, then for a minimum aggregate mileage of cable laid, there is one and only one theoretical position on the map, for the location of a single central office in the district. This position is such as would be obtained by taking a flat, rigid map of negligible mass—say a sheet aluminum map—laying thereon a certain weight—say a milligram—in the position of each telephone to be installed, and then finding the center of gravity of the distributed masses after correcting for the restraints imposed by the streets. This is the same proposition as applies to an electric lighting station to supply a given distribution of lamps with minimum outlay of conductors. Party telephone lines, however, theoretically modify the proposition somewhat; for if, say, four telephones are connected to one line at successive distances of half a mile, the central telephone station might be situated anywhere along the two miles of route, and not modify the amount of line-wire to be required. The location of a telephone station supplying a party line distributing system is therefore somewhat more flexible, theoretically, than one which supplies individual subscribers' lines only.

The Vacuum Tube Lamp.

The paper read by Mr. D. McFarlan Moore at the recent Institute meeting is an interesting record of considerably more than a decade of persistent and often discouraging experimentation leading finally to results which appear now to have reached a commercial stage, even if one does not share the inventor's own roseate view of the future. Beginning with methods later discarded, the tube lamp has undergone a process of evolution leading to a device which, although seemingly of special rather than of general adaptability, is worthy of consideration by illuminating engineers. Its strong points are its low intrinsic brilliancy and reasonably good efficiency as compared with the carbon filament lamp. It stands alone among artificial illuminants in having an intrinsic brilliancy low enough safely to be used unscreened in the field of view. It has the practical disadvantages of a special high-tension transformer which must be enclosed in a suitable safety box, a highly ingenious automatic

vacuum valve which has extremely important functions, and a glass tube 100 or more feet long, involving "glass plumbing."

The quality of the light is determined by the gas in the tube, and the modifications obtained by the use of nitrogen for yellowish light and carbon dioxide for whitish light are secured in ways that are simple and easy. The range of color could be still further increased without much difficulty, although in most cases at some loss of efficiency, the yellowish nitrogen tube, which presents chiefly orange and greenish yellow bands, being for this reason of the best efficiency. The efficiency figures quoted pertain to this particular gas. The quality of the light is decidedly good and pleasing to the eye. Two of the conspicuous weak points of the system are its low power factor and the relative inefficiency of short tubes, which renders sub-division extremely troublesome. The former difficulty is, at least, in part avertable, while the latter seems to be inherent. The present average intensity of the tubes being about 12 hefners per foot, most rooms would be adequately lighted by 8 ft. or 10 ft. of tube. Data on such short tubes are not given in the paper, but to judge from the curve shown they would require 4 or 5 watts per hefner (4.5 or 5.7 watts per candle-power). The best work seems to be obtained from tubes 100 to 200 or more feet in length, such as would be used in large halls, stores, churches and other extensive spaces. For such cases the transformer box can be easily located in a safe position and is not an objectionable feature of the system, which it well might be in the case of attempting subdivision of the light for small rooms.

The life of the tubes appears to depend on casualities rather than upon any form of continuous deterioration. There is no cause for blackening as in incandescent lamps, although there may prove to be some eventual action on the interior of the tube sufficient to impair its transparency. As to other contingencies which may increase the cost of up-keep, few data are available. There is occasional trouble with the vacuum, a chance for breakage or leakage, and the chance of failure at the transformer. To what point these troubles can be reduced remains to be seen in the hard knocks of commercial service. We regret that Mr. Moore put out the extraordinary figures on alleged illuminative efficiency which occupy a prominent place in his paper. One quite instinctively asks by what kind of hocus-pocus they were secured. If illuminometers are accustomed to do this kind of thing they certainly need improvement. The tube lamp is merely a linear source giving a certain number of hefners per foot. Its distribution of light is certainly no better than, and probably not quite as good as, that given by a row of incandescents of similar luminous output in the same position, and if the tube gives apparently an absurdly higher illumination it is merely a sign that the comparison was at fault, or that the incandescents actually installed were very badly located. Claims of this kind will do more to discredit the good points of the tube system than any amount of criticism from rivals. Mr. Moore has no cause to be ashamed of the performance of the tube in watts per hefner, but it possesses no occult powers of enhancing the flux of light due to its intensity.

THE DROP OF PRESSURE AT THE COMMUTATOR CONTACT OF CARBON BRUSHES.

The *Elektrotechnische Zeitschrift* has recently published an interesting research, by Messrs. E. Arnold and E. Pfiffner, on the influence of temperature upon the contact resistance between carbon brushes and running commutators. This is a matter of great practical importance in relation to sparkless commutation. The article shows that if the reactance voltage of the coil undergoing commutation exceeds an effective value of 0.8 times the brush-contact voltage-drop, the commutation is endangered; whereas, if on the contrary, the effective reactance voltage can be kept below this value, quiet, or substantially sparkless commutation is assured. Since the reactance voltage is commonly from one-quarter to one-half of a volt, the brush-contact drop must be at least one-third of a volt, and in some cases two-thirds of a volt, in order to satisfy the sparkless condition. In order to investigate the influence of commutator temperature upon the voltage drop in brush contacts, a rotatable contact drum, or large bronze slipring, was built, having a breadth of a decimeter, and a diameter of 320 mm. A nickelin winding was disposed beneath the surface of this drum, so as to carry an independent current, and to heat the same to any desired temperature, the carbon brushes being maintained at a constant pressure of 160 grams per sq. cm. upon the rotating drum surface. An additional embedded insulated copper-wire winding enabled the temperature of the drum to be measured electrically. Incidentally, the figures given show that when running at 100° C., or at a temperature elevation of some 85° C., the drum took about one-twentieth watt per sq. cm. of its cylindrical surface, or dissipated about three times as much power as if equally raised in temperature but stationary.

The phenomenon of contact resistance between a carbon brush and a revolving metallic cylinder is very complex and depends upon a number of variables, including not only the temperature of the contact but also the pressure per unit surface, the speed, the current density, the direction of the current and the chemical actions at the contact. In order to secure consistent results it is necessary to vary only one of these quantities at a time and even then irregularities due to accidental changes in the others, are likely to obtrude themselves. The article shows that the contact drop with the various kinds of carbon experimented with varied between the limits of 1 volt and 0.03 volt. As the temperature was increased, the contact drop fell in a somewhat irregular manner, but in a general way, it fell about 50 per cent for a temperature elevation of 30° C. and about 80 per cent for a temperature elevation of 60° C. Consequently, a brush which gave a drop of 0.5 volt at the initial temperature of 20° C., would give about 0.25 volt at 50° C. and about 0.1 volt at 80° C. The article points out that at high contact temperatures, such as those which may be developed at turbine commutator speeds, the contact drop of voltage may fall below the reactance voltage, and produce troublesome sparking at the rated load. Every effort should, therefore, be made to keep down the temperature of the commutator, in order to sustain the commutator contact drop. Moreover, since this drop is not numerically the same at the positive and negative brushes, being ordinarily greater at the negative brushes or with carbon anodes, different kinds of carbon for negatives and positives might, in certain cases, be chosen with advantage.

It is interesting to note that the temperature of the revolving drum in these experiments was indicated about 15° C. lower by applied thermometers than by embedded copper winding tested electrically. This is, of course, consistent with general

experience, which accords to the thermometer a lower indicated temperature-elevation than the resistance measurement of coils. Nevertheless, it is impracticable to use resistance measurements for determining commutator temperature elevations, and moreover coils are often deeply embedded and are subject to a higher temperature than the superficial metal of a dynamo rotor. The same research was extended to determine the contact resistance of a carbon brush at one and the same temperature elevation such as occurs in practice and with a variable current-density in the contact surface. The results obtained, although in general already known, are very noteworthy. The resistance depends on the direction of the current as already observed. For a given direction, the contact resistance increases almost inversely as the current-density, and is commonly about one-twentieth of an ohm, plus half an ohm divided by the current-density in amperes per sq. cm.

Non-Peak Sign and Window Lighting.

Flat-rate sign and window lighting, which is turned on and off by the central station employees, and used a certain definite number of hours per year, has come to be a very satisfactory source of revenue to many central station companies. It is good business even when taken at low rates, for the reason that the lighting usually averages four or more hours per day, which is considerably better than many other classes of lighting business. Consequently the fixed charges per kw-hour against it are much less than on most other classes of lighting. It has been proposed in a tentative way at various times to secure this business under contracts which will prevent it being turned on during the winter peak load. The objection has always been raised, quite naturally, that customers want sign, window and display lighting of various kinds during the early part of the evening more than at any other time because there are then more people on the streets. The attempt now being begun at Cincinnati (as noted elsewhere) will be watched with considerable interest by all central station men developing a sign and window-lighting business. The company there is attempting to get this class of business under a contract whereby it will be turned on at 6 p. m. between the months of September and April. As the company's station peak in November and December comes about 5 p. m. and has fallen off considerably at 6, a considerable amount of flat-rate sign-window lighting could be taken under such contracts without affecting the yearly winter peaks in the least. As compensation to the customer for losing the value of his sign during the first hour of darkness a better rate is given than could be made if it were not during the peak. At the same time he has his signs lighted at 6 o'clock, about which time there are usually more people on the street than at 5.

It is not always safe to predict just how these attempts for non-peak business will come out, and, therefore, there is much interest attached to the Cincinnati campaign. A few years ago we were assured, notwithstanding the example of Montreal, that it was impossible to get non-peak power business. Some enterprising central station managers were, however, unorthodox enough not to accept this view and went about to secure large power contracts with the provision that during the months of November, December and January power could be turned off by the company during the peak period. If some power users will take power on such a contract by virtue of a lower rate, it is not unreasonable to suppose that some sign users will do the same, especially those having signs or billboards in the outlying districts of the city.

New Illuminants and Street Lighting Contracts.

The new electric illuminants now coming into the field for street lighting naturally raise some nice questions in connection with contracts to be made between central station companies and cities for street lighting. Several years ago the introduction of the enclosed arc lamp as a substitute for the open arc involved some similar questions and much greater difficulties from the central station man's point of view. The enclosed alternating-current arc lamp equipped with an opal inner and clear outer globe was more satisfactory for street lighting than the old-fashioned open arc lamp of the same watts, though its total or mean spherical candle-power was almost one-third less than that of the open arc, and as seen on the street by the casual observer who judged by its glare, it did not appear to be as powerful an illuminant as the open arc. The present situation is a much easier one to handle, since it involves questions of substituting more efficient illuminants, both arc and incandescent, for those now in use, and it is possible at the same time to give the city better street lighting and to reduce the cost to the company.

The change to luminous arcs, for example, in some cases involves throwing out an open arc equipment which is antiquated and ready for the scrap heap, anyway. In other cases where enclosed alternating arcs are in use, the change to the more efficient luminous arc will involve such a sacrifice of present equipment that central station companies will have to see considerable profit over and above operating expenses to justify the immediate wiping out of old investment and the creating of new. In incandescent street lighting the new higher efficiency incandescent lamps will not involve any great additional investment; so that as far as they are concerned, the situation is easy to handle, as a company can simply substitute new efficient lamps for the old inefficient ones. In cases where a company substitutes a more efficient arc lamp for the common arc, the city certainly has no right to complain if the company puts in a lamp giving as good illumination as before on the street, the saving going to the company to pay it for its extra investment. In the course of time a company should be able to reduce its price on street lighting as a result of the improvements. The question seems to be one which should be settled between the city and the company as to what portion of saving should go to the company and what portion to the city. In cases where the company's present arc-lighting system is not already worn out and ready for renewal, it is in order for the company to point out to the city that a more efficient street-lighting system is now available, but that the company cannot afford to put it in unless a price is secured for street lighting which will warrant the company making a change of its street lighting system.

The technical questions involved in street-lighting contracts and the change to more efficient illuminants emphasizes more than ever the advisability of cities' securing technical advice when entering into such contracts. It is much more satisfactory for a central station company to deal with technical men

in such a matter than with those who know nothing about the values of different illuminants and who are suspicious that every suggestion of the company may have behind it a motive to give the city a poor bargain. An engineer is much more important than a lawyer in drawing up a street-lighting contract, in view of the much mixed-up condition of candle-power ratings of street illuminants. Controversies such as the notable one at Colorado Springs are likely to occur in many cities almost any time, and will keep on occurring until the rating of lamps and drawing up of street-lighting contracts are on a more satisfactory basis than it generally is at present. The great majority of street-lighting contracts which at the present time have the technical meaningless specification for lamps of 2000 or 1200-cp, were so drawn up, not with the intent of the central station company in question to deceive, but simply to avoid the unnecessary confusion and agitation which the introduction of the question of candle-power with non-technical city officials would be sure to raise. It is certainly not desirable either for a company or a city to specify simply a lamp using a certain number of watts, as that would prevent the substitution of more efficient lamps. In view of the questions that are likely to arise in connection with the introduction of the luminous and other efficient arc lamps, the experience at Louisville, Ky. (printed elsewhere in this issue) is valuable as establishing a precedent which is likely to be favorably considered by other cities where such a change is contemplated. In this case the city authorities not only consent to, but urge the substitution of, four-ampere, 70-volt luminous lamps for 9.6-ampere open arc lamps.

THE REASON SOME GASOLINE PLANTS EXIST.

Many central station managers operating in towns of small or medium size are longing for means to meet the competition of private gasoline lighting plants. We recently looked into conditions in a town of about 4000 population where some half-dozen such gasoline plants had been installed in the business district. The conditions there were so similar to those in many other towns, and the methods which should have been pursued to meet this competition were so apparent, that a review of this particular case may be of value. The electric light company's rate was 10.8 cents per kw-hour with no discounts. An inspection of the business streets at night showed that the gasoline plants were installed in places keeping open after 6 p. m., or in other words, in the very establishments which were formerly the most profitable commercial customers of the electric light company. Thus the gasoline plants had taken the cream of the commercial business, leaving the central station the skim milk. The central station was carrying a big investment to serve simply the class of commercial customers using service only a limited number of hours per month. The reason the gasoline plants had found a footing was primarily that electric lighting was costing the long-hour customers inordinately under the existing system of rates. It was also evident that by virtue of a lack of illuminating engineering, the former customers who had adopted gasoline lighting had not been getting anything like the effective illumination that they should. Most of them could have obtained greatly improved results at slight expense for changes. Aside from the illuminating engineering factor, however, the great obstacle in the way of the central station service was evidently the rate. The rate is already low, the company's officers think, but it does not occur to them that more money could be made with a lower rate or that there is any way of lowering it for this class of long-hour customers without lowering it for all customers.

The fact is that if the rate is right for the stores that close at 6 p.m., it is too high for those keeping open all the evening. It is one of the fundamental principles of rate making that it costs less per kw-hour to serve a customer whose demand extends over four or five hours a day than with a one hour per day demand. The question then is how to make a rate which can be given without discrimination to any customer desiring it, that will lower the cost per kw-hour to consumers using current many hours per day, and so lessen the temptation to put in gasoline plants. We find plenty of precedent for such rates among the more successful large companies which have had to meet the competition of isolated electric plants; a problem in many respects similar to meeting the competition of gasoline plants. One method is the adoption of the readiness to serve rate according to which the customer is charged a fixed rate of about $2.50 or $3.00 per kw connected, plus a rate of 4 to 6 cents per kw-hour for energy. This rate is optional. The short-hour customers do not want such a rate, as it is no advantage to them, and it is availed of only by the long-hour customers, and these the company can afford to take on at such a rate. Another method of accomplishing a similar result is the multiple rate system where the customer is charged the full rate for the first 30 hours' per month use of his connected lamps, a lower rate for the second 30 hours' use, and so on. By either system the customer is given (as he should be) a low rate per kw-hour after the fixed charges incident to his installation are taken care of. We do not, for a moment maintain that even by a proper system of rates and attention to the illuminating engineering of a customer's installation a gasoline plant can always be kept out; but by attention to these two matters a very deterrent effect can be exerted on the growth of the gasoline plant business. It goes without saying that the company as a foundation should have a reliable service and good voltage regulation. In the plant in question there was a constant disagreeable flickering which, although slight and the service otherwise excellent, could not fail to have an influence against the central station.

It may not be out of place here to point out some of the things to be avoided when making rates to meet gasoline competition. Some companies have very unwisely simply put the regular rate down 30 to 50 per cent to customers about to put in gasoline plants. Such a move is sure to make trouble for the company for the reason that it is illogical and savors of discrimination which the public will tolerate less and less as time goes on. Rate reductions, to be logical and non-discriminating, must depend entirely on the character of a customer's load and what it costs to serve him, and not on the size of the club he holds over the company's head in the shape of threatened competition. If John Smith is given a 5-cent rate because he may otherwise be lost as a customer, John Jones, who has always paid 10 cents without a murmur, has a right to ask why he should help pay the deficit on John Smith's business; or if there is no deficit, why he should be charged 10 cents. The only satisfactory rate system is one that is open to all comers and in which the prices are graded according to the cost of giving the particular character of service the customer requires.

Death of Mr. W. J. Johnston.

We regret to announce the death of Mr. W. J. Johnston, former proprietor of this journal, which occurred from cerebral hemorrhage at 11:30 p. m., Sunday, April 28, immediately after his return home from a visit to Washington. Mr. Johnston had been in vigorous bodily and mental health and the untimely end arrived when, after several years of strenuous effort, he had brought his latest publishing enterprise to a point that would have permitted an easier pace. With the appearance of a man under the age of forty in the natural course he would have had remaining a long and productive period of life.

Mr. Johnston was born at Ballycastle, Ireland, in 1851, and as a youth took up the occupation of telegraph operator. In

MR. W. J. JOHNSTON.

1868 he came to the United States, and after returning to Ireland, took up his permanent residence in this country in the early seventies. In 1874 several Western Union telegraphers founded *The Operator*, to which Mr. Johnston at once became a contributor; in November, 1875, his name appears as part proprietor, and with the issue of January 1, 1876, he became sole proprietor and editor. In December of 1875 he was notified by the Western Union Company that his continued employment with that company would depend upon his giving up all connection with *The Operator*. In reply Mr. Johnston stated that he failed to see in what particular his connection with that journal, the work on which was necessarily done when off duty in his own time, could be injurious to the interests of the company: "I have taken a great deal of pains to make *The Operator* a paper worthy of the profession, and have been very successful so far in my humble efforts; therefore, I cannot allow it to sink into oblivion without at least a struggle." Mr. Johnston then tendered his resignation, and in commenting editorially upon the attending circumstances, dwelt upon the absolute necessity in the conduct of any publication, of absolute journalistic independence of every interest in its field.

The Operator was published as a semi-monthly until January 6, 1883, when it assumed the name of *The Operator and Electrical World*, which title in April, 1883, was abridged to *Electrical World*. In 1899, after selling the journal to the present owners, Mr. Johnston took a trip around the world, and on his return in 1900 began the publication of *Mining and Metallurgy*, which in the following year was merged with the *Engineering and Mining Journal*, of which he had become one of the proprietors. In 1903, while still connected with the latter journal, he started the *Pacific Coast Miner*, and shortly afterward ceased his connection with the *Engineering and Mining Journal*. In 1904 he began the publication of the *Mining Magazine*, which was issued under his proprietorship until last year. In 1905 he purchased an interest in the *American Exporter*, of which he later became sole proprietor. In the interest of this publication and for the study of export trade conditions he made a trip around the world and several other extensive foreign trips, and had brought the journal to an excellent position at the time of his death.

A sanguine disposition, an extraordinary persistency of purpose and indefatigable industry combined to give special prominence to Mr. Johnston in any field in which he labored. His inflexibility of purpose at times gave rise to friction in his relations to men, but his integrity was above attack and an innate kindliness and a social disposition endeared him to a large circle in private life, and to all in business life who came to appreciate his sterling qualities.

Technical journalism owes much to Mr. Johnston. A generation ago he fixed a standard of fearlessness and independence in editorial conduct which was then rare, and nothing subsequently ever swerved him from the principle that the editorial pages of a technical journal should, like Cæsar's wife, be above all suspicion. He was an associate member of the American Institute of Electrical Engineers from its foundation, a member of the American Institute of Mining Engineers, and a past president of the American Trade Press Association.

The Engineering Societies Commemorative Medal.

On April 17, Founders' Day, the dedication of the new Engineering Societies Building, West Thirty-Ninth Street, New York City, had associated with it the presentation of "Distinguished Service" gold medals, to Dr. R. W. Raymond, secretary of the American Institute of Mining Engineers, Mr. R. W. Pope, secretary American Institute of Electrical Engineers, and Prof. F. R. Hutton, secretary American Society of Mechanical Engineers. We reproduce herewith the reverse of this medal, full size. Dr. A. R. Ledoux, past president of the Mining Engineers and of the United Engineering Society made the presentation at the request of Chairman Lieb, and did so in very graceful and felicitous terms. In the course of his remarks, he described the medal and said: "In order to give pub-

ENGINEERING SOCIETIES COMMEMORATIVE MEDAL.

lic expression to the appreciation of these three founder societies for their three great secretaries, there have been prepared by the distinguished artist, Victor Brenner, three identical gold medals. Upon one side there is depicted a figure representing the spirit of invention and research, typified by a youth who holds in his hand a tablet, upon which his attention is fixed. Enveloping him is a cloud of steam, which rises from the stack of a modern locomotive, typical of mechanical engineering. Above appears the top of a blast furnace. Below and at his right hand appear the emblems of the "Founder Societies"

encircled by an olive wreath, while opposite is a view of our present building, with an inscription reciting the fact and date of its dedication. Above the seated figure are suggestions of the work of the electrician and miner, represented in the one case by a high tension electric line and in the other by men operating a power drill. Upon the obverse of each medal are inscribed the circumstances of its bestowal, and the names of its recipient."

The original design of the medal has been presented to Mr. Carnegie as a souvenir of the event, which included also the unveiling of his bust in the library.

April Meeting of the A. I. E. E.

At the meeting of the American Institute of Electrical Engineers, held at the Engineering Societies Building, on April 26, two papers were read and discussed simultaneously. A paper by Mr. S. P. Grace, entitled "The Telephone Wire Plant," was presented in the main auditorium, while a paper by Mr. D. McFarlan Moore, entitled "Light from Gaseous Conductors Within Glass Tubes," was presented in assembly room No. 2, which was illuminated with the Moore tube lamp.

TELEPHONE WIRE PLANT.

A considerable portion of the paper by Mr. Grace dealt with the problem of determining the probable equipment to be required for future use. It was stated that an analysis of the construction cost of the total telephone equipment shows that from two-thirds to three-quarters of the total expenditure is required for the outside plant; that is, for conduits, poles, cables and wire. The author stated that until recently the type of distributing wire most generally used was made of No. 14 B. & S. gauge copper. It was not necessary to use so large a wire for conductivity, but it was required for mechanical strength. During the past year there has been put on the market a copper-clad steel wire made by a new method. Copper is welded to a steel ingot and the copper and steel are drawn out uniformly together. A No. 17 copper-clad wire having a conductivity of 30 per cent of that of copper has the same tensile strength as a No. 14 hard-drawn copper wire. Thus, the new wire allows the material used in distribution to be reduced by one-half, and, what is still more important, allows a considerable reduction in the amount of expensive rubber compound required to surround the wire. The finished wire is very light and easy to handle, and it costs approximately 30 per cent less than the No. 14 copper wire. There is so much sulphurous smoke in the atmospheres of cities and towns that iron wire is soon destroyed, and it is uneconomical to employ such wire. In such localities copper wire has generally been used. It would seem that the copper-clad steel wire would prove especially useful for such work, because it has the required tensile strength and sufficient conductivity, and yet costs only about one-half as much as copper.

DISCUSSION.

The discussion of Mr. Grace's paper was opened by Mr. J. J. Carty, who remarked that the telephone switchboard has held the center of the stage too long, and that it is now time that attention be directed to some of the numerous other features. The importance of the telephone wire plant will be appreciated when it known that in Greater New York there is used in round numbers 1,000,000 miles of copper telephone wire. Most of this wire is enclosed in lead-covered cables. The superficial area of the lead pipes covering all of the cables in this system amounts to 190 acres. A puncture in one of these pipes no larger than a pinhole will admit moisture and sooner or later cause a fault, producing an interruption of the service of one or all of the circuits within the cable.

Mr. H. V. Hayes stated that a combined steel and copper wire has been on the market in Europe for many years. However, its use at the present time must be considered as an experiment. On account of the importance of the wire plant in a telephone system, it would be well to make such experiments with great caution. The results of the experiments being made by Mr. Grace will prove of much value to the telephone industry.

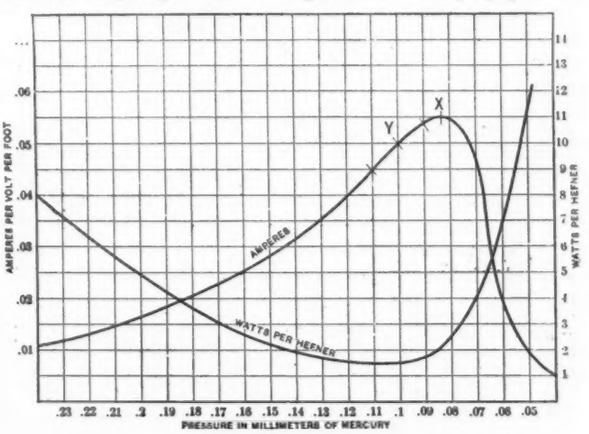
Mr. G. M. York called attention to the fact that extensive use of cables for long distance transmission is absolutely impossible. The inefficiency of the cable in transmitting speech still exists in spite of improvements in cable manufacture that have recently been made. As an example of the relative inefficiency of cable circuits, he stated that one of the regular lines from New York to Chicago transmits speech as well in volume and in quality as a cable circuit only 20 miles long. It would seem, therefore, that the overhead wire circuit will not be displaced merely because it is unsightly, but it will continue to be used for long-distance telephone service.

Mr. Gilman remarked that the prime requisite for the wire that is used between the cable terminals and the subscriber's station is that it must be of first-class quality and must maintain its insulation. The rubber compound itself will not last unless it is properly protected. Protection is usually given by the cotton braid. The braid, however, will not withstand heat and moisture unless it is properly protected, so that the whole problem resolves itself into one of protecting the braid.

Mr. K. B. Miller expressed the opinion that the description of practices in different parts of the country and a frank discussion of them are just as necessary and desirable in telephony as in any of the other arts. A tendency that is to be noted is the diminishing field for rubber insulated wire in telephone plants. There is no form of cable known that can be advantageously used in telephony except the paper-insulated cable. For many purposes other than telephony, the greater reliability of rubber-insulated cable renders it much more desirable than the paper-insulated cable.

THE MOORE TUBE LAMP.

In his paper Mr. D. McFarlan Moore described the latest form of the tube lamp with which his name is associated. The lamp consists of a continuous glass tube about 1.75 in. in diameter and of any length not exceeding 200 ft. The lamp equipment is



ELECTRICAL AND LUMINOUS CHARACTERISTICS OF LAMP.

operated from a 60-cycle alternating-current supply at any commercial voltage, the e. m. f. being increased to the value necessary for operating the tube by means of a stationary transformer. The high-potential terminals of the transformer are attached directly to the electrodes within the glass tube. The lamp terminals and all of the transforming apparatus and high potential circuits are enclosed within a steel-plate terminal box.

An interesting feature of the lamp as now constructed is an automatic feeder valve which serves for maintaining the vacuum at the desired degree. Experience has shown that when no provision is made for the supply of gas to the tube, the vacuum tends to become higher in time due to the fact that a portion of the residual gas within the tube is absorbed during the operation. The resistance of the gaseous conductor within the tube is a minimum for certain degrees of exhaustion, and it increases rapidly as the exhaustion increases or as it decreases as shown by the accompanying curve. The critical degree of vacuum at which the conductivity is a maximum is shown at the point *X*. The tube is normally operated at a lower vacuum corresponding to the point *Y*. It will be observed, therefore,

that as the electricity uses up the gaseous conductor, the vacuum becomes higher, the conductivity better and a greater current flows through the circuit. Use is made of this characteristic of the vacuum tube to maintain the vacuum at the desired degree. A feeder valve is arranged to permit air or other gas to enter the tube just when it is needed and in an entirely automatic manner. This valve is in reality a mercury seal operated by means of an electromagnet whose coil is connected in series in the supply circuits. The mercury serves to seal the pores of a carbon plug. The action of the solenoid is to lift a concentric glass tube partly out of the mercury, the surface of which falls and thereby causes a minute tip of the conical-shaped carbon plug to be slightly exposed for a second or two and an extremely small quantity of air or other gas filters through the porous section of the plug and finds its way into the vacuum tube proper. In normal operation the carbon tip is exposed for about one second every minute. When the air is admitted the resistance of the tube increases and the current through it decreases, and therefore the feeder magnet becomes weakened and the air or gas inlet is closed.

The luminous efficiency of the tube lamp depends not only upon the value of the current at which it is operated, but varies with the nature of the gas used in the tube. Carbon dioxide gas gives a perfectly white light, while the light from nitrogen gas has a pink tint. When it is desired to feed the tube on nitrogen, air is made to pass through a small iron cylinder containing a supply of phosphorus. In order to prevent more air than necessary from coming into contact with the phosphorus, the air is required first to pass through a small mercury trap. When the tube is to be fed with carbon dioxide gas, the gas is generated automatically by means of the action of hydrochloric acid on marble.

DISCUSSION.

Dr. C. P. Steinmetz stated that Mr. Moore's paper furnished the first actual engineering data relating to the tube lamp; that is, the actual power, current and illumination. By changing over the units employed in measuring the illumination from the tube lamp to the units ordinarily used with incandescent and arc lamps, he showed that the Moore lamp consumes about 2.5 watts per mean spherical candle-power. Thus its specific consumption is less than that of the carbon incandescent lamp, about equal to that of the tantalum lamp, but is inferior to that of the tungsten lamp. These values refer to the lamp with which the nitrogen gas is used; the specific consumption of the tube using carbon dioxide is somewhat greater. The Moore tube lamp has, therefore, arrived at that stage where it is in the range of commercially practical efficiency as an illuminant. The lamp has been enormously improved within the last few years. One of the most important and valuable features of the present lamp is the valve by which the nitrogen or carbon dioxide is automatically fed to the tube. The production of a valve which is capable of maintaining a vacuum of about .000125 of atmospheric pressure is indeed a remarkable achievement.

Mr. Percy H. Thomas remarked that in addition to supplying a new candidate for commercial favor among the illuminants, Mr. Moore has done a good deal to educate illuminating engineers to consider the importance of diffusion and distribution in lighting. The diffusion from the Moore tube is perfect in one plane, but very imperfect in a plane at right angles thereto. It is even possible with incandescent lamps distributed over the ceiling to get a more perfect diffusion than with the tube. Undoubtedly there is a field for the tube lamp. Its good points are its relatively high efficiency, its diffusion and the fact that it produces no bright, brilliant spots. Its chief difficulties will be found in a tendency to fail at times. When the whole illumination in a room is dependent on one or two lamps, it is impossible to use a small portion at one time. This fact merely indicates a certain limitation when the broad field of illumination is considered, but it cannot be urged against the tube for all places.

Dr. C. H. Sharp stated that the tube containing nitrogen is about twice as efficient as the one using carbon dioxide, the watts per candle for the latter ranging from 3 to 5.8. The gain in efficiency of the nitrogen tube over the carbon filament lamp is by no means revolutionary. Its efficiency is considerably less than that of the tungsten lamp. The indivisibility of the light from the Moore lamp will probably make it necessary in all or nearly all of the installations where it is used to supplement it by some other lighting system, because it would not be proper to place all the reliance for the lighting of a room upon a single glass tube.

Mr. J. W. Howell stated that Mr. Moore had for 12 years stuck to his work of producing a commercial tube lamp with a persistence and enthusiasm which he had never seen equalled. He has added a commercial illuminant which is applicable for many places, such as the art gallery, because when it is installed all elements of danger are eliminated.

Mr. Leon Gaster, of London, England, remarked that, while the Moore tube had been developed before high-efficiency incandescent lamps had been introduced, it is unfortunate that it must now compete with the more recently introduced tungsten and similar high-efficiency lamps, which consume only one watt per candle. Thus the excellent work of the inventor will not receive the financial reward which it deserves.

Chairman Gano S. Dunn called attention to the fact that from illuminating tests made upon the three lighting equipments installed in the lecture-room, it was found that 10 kilowatt was required for the lamps behind the cove; 5 kilowatts with naked lamps strung around the border, and 5 kilowatts to illuminate with the Moore tube. It was evident to all that the tube gave a brighter light than either of the other systems. The test was a practical one, concerning which there could be no discussion as to photometry, brilliancy or efficiency.

Fuses in the Neutral of Three-Wire Systems.

The following changes and additions were made at the March meeting of the National Board of Fire Underwriters to the rules governing the installation of fuses in the neutral of three-wire systems:

Rule 17, Section *a*, was amended to read as follows:

Must for constant potential circuits, unless otherwise provided (for exceptions as to switches see Nos. 8 *c* and 22 *c*, for exceptions as to cut-outs see No. 21 *a* and *b*), be so arranged that the cut-outs will protect and the opening of a switch or circuit breaker will disconnect all of the wires; that is, in a two-wire system the two wires, and in a three-wire system the three wires, must be protected by the cut-out and disconnected by the operation of the switch or circuit breaker.

Rule 21, Section *a*. Add the following fine print note:

For three-wire (not three-phase) systems the fuse in the neutral wire may be omitted *(provided the neutral wire is of equal carrying capacity to the outside wires and is grounded as provided for in Rule 13A).*

Rule 21, Section *b*. Fine print note to read as follows:

For three-wire (not three-phase) systems the fuse in the neutral wire except that called for under No. 21 *d*, may be omitted *(provided the neutral wire is of equal carrying capacity to the outside wires and is grounded as provided for in Rule 13A.*

Rule 21, Section *d*. Amend to read as follows:

Must be so placed that no set of incandescent lamps requiring more than 660 watts, whether grouped on one fixture or on several fixtures or pendants, will be dependent upon one cut-out.

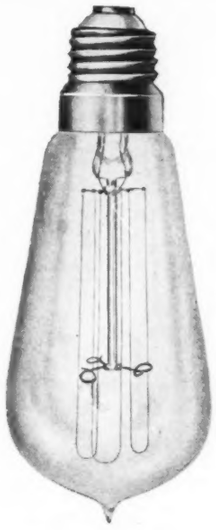
Special permission may be given in writing by the Inspection Department having jurisdiction, for departure from this rule, in the case of large chandeliers. All branches or taps from any three-wire system which are directly connected to lamp sockets or other translating devices, must be run as two-wire circuits if the fuses are omitted in the neutral, or if the difference of potential between the two outside wires is over 250 volts, and both wires of such branch or tap circuits must be protected by proper fuses.

It is also necessary that the last fine print note under Rule 21, Section *d*, be omitted, the substance of it being incorporated in the rule itself.

The Tungsten Lamp in America.

The recent developments in the incandescent lamp field have come thick and fast, and it now looks as though the scientific and technical perfection of some of the newer lamps is to be followed up promptly by their industrial and commercial introduction. There is no question that the attitude of the 4000 central station companies of the country and the 50,000 owners of isolated plants is one of warm welcome for many reasons. Aside from the fact that this places another source of supply of lamps, at command, the danger of shortage will be appreciably reduced; besides which, the lower energy consumption should carry the lamp into departments hitherto unconquered.

Mr. Julius Auerbach, president of the Electrical Accessaries Company, returned last week on the "Deutschland" from Europe, where he spent nearly two months in Austria and Germany with the manufacturers of the "Just" tungsten lamp,



TUNGSTEN LAMP.

He has succeeded in contracting for large quantities of these lamps to be forwarded from Europe in weekly shipments. These "Just" lamps are well known in the different European countries, as they are used there in a good many places.

Mr. Auerbach reports great progress and success in the manufacture of these lamps. The German factories are running out now about 5000 lamps a day, and Hungarian factories about the same quantity. Both factories are working day and night in order to supply the demand, and are increasing their facilities.

While the Electrical Accessaries Company is importing at present only 40-cp lamps, these factories are making now also 20-cp and 30-cp lamps for 100 to 125 volts and 50-cp lamps for 200 and 250 volts, the latter with only 5 filaments.

When it is considered that these lamps burn 1000 hours with no decrease of candle-power during the entire life, these tungsten lamps mean a great step forward in the art, and will be studied and examined with interest throughout the field of electric lighting.

Details have appeared in these columns from time to time, and the lamp was illustrated September 1, 1906. An engraving of it is herewith presented.

Technical Publicity Association.

The Technical Publicity Association held its third annual meeting, election of officers and monthly dinner at the rooms of the Aldine Association, 111 Fifth Avenue, on the evening of April 18. Upon a motion made by Mr. F. F. Coleman, of the Lidgerwood Mfg. Co., all the officers of the preceding year were re-elected, as follows: President, E. H. Gale, General Electric Company; first vice-president, E. M. Cleaver, Niles-Bement-Pond Company; second vice-president, C. B. Morse, Ingersoll-Rand Company; treasurer, H. M. Davis, Sprague Electric Company; secretary, Rodman Gilder, Crocker-Wheeler Company. H. M. Kress, of the Cameron Pump Company, and F. F. Coleman, of the Lidgerwood Mfg. Company, were elected to the executive committee. C. W. Beaver, Yale-Towne Mfg. Company, C. N. Manfred, H. W. Johns-Manville Company, and H. C. Spaulding, Triumph Electric Company, were elected to the membership committee. Mr. Kress was reappointed to look after the dinners and Mr. Coleman was elected as press representative.

The following new members were elected: J. V. Downie, advertising manager Keystone Driller Company; B. F. Hardesty, advertising manager the Lehigh Valley Railroad; P. P. Fox, advertising and industrial agent of D. L. & W. R. R.; David Gibson, advertising manager Globe Machine Stamping Company; C. W. Miller, secretary Jeffrey Mfg. Company; H. L. Meyers, N. Y. Leather Belt Company; J. Cecil Nuckols, advertising manager Obermeyer Company; Paul Robertson, advertising manager Atlas Engine Works; E. W. Strong, American Locomotive Company; Ernst Stutz, general manager and vice-president Goldschmidt-Thermit Company; Barrett Smith, publicity manager J. G. White & Company; W. G. Snow, manager of publicity International Silver Company, and Stuart Benson, advertising manager R. Wallace & Sons Mfg. Company.

The Association has doubled its membership during the last year, and now has 62 members, representing many of the most important houses in the country which use the technical press for advertising. The discussions at the monthly meetings have excited a large amount of interest and it is expected that during the coming year the membership will again double. One of the important matters that will be discussed at an early date will be the subject of mailing lists. This is to be taken up exhaustively, including the formation and keeping up to date of mailing lists, the conditions under which a mailing list can be economically used, and the various methods of using it.

An offer of a booth at the Advertising Show to be held at Madison Square Garden May 16-23 was accepted, and arrangements were made to have the officials of the association present on each day and evening to receive members of the association and their friends.

Underwriters' Rules Governing Electric Signs.

At the recent meeting of the Electrical Committee of the National Board of Fire Underwriters, the following report on the requirements and specifications for the construction and equipment of electric signs, was adopted for laboratory use. These rules will not appear in the revised edition of the "Code"; but will be printed in the "List of Fittings" for information. Signs not conforming to these regulations will not be approved by the Underwriters.

1. Wiring and devices in all signs located outside of buildings will be considered as exposed to moisture.

2. Wires carried on the outside of the sign structure must be run in approved metal conduit or approved armored cable.

3. Wires within structure of sign must be double braided, and may be carried within ½ in. of each other and of surrounding metal. Where such spacing is impracticable, such wires may be cabled if ½-in. spacing is maintained, and if cable contains wires of only one polarity.

4. Must be constructed entirely of metal or other non-combustible material, except that wood may be used on the outside for borders if kept at least 2 ins. from nearest lamp or socket. In case of ornamental scroll work or similar design, where impracticable to support wires as above provided, they may be separated from such metal by sections of porcelain or glass not less than ⅛ in. in thickness.

5. Sheet metal must not be less than No. 26 B. & S. gauge.

6. Must be braced by angle iron of such thickness and so placed as to secure sufficient strength and rigidity.

7. All metal must be galvanized or enameled, or treated with at least three coats of anti-corrosive paint or compound.

8. If the terminals of receptacles are not the enclosed type, the receptacles must be so constructed that the terminals will be at least 1 in. from surface wired over. Wires must be soldered to such terminals and exposed parts treated to prevent corrosion.

9. Bottom of sign must have at least a ¼-in. drainage hole for each square foot of its surface.

10. Where wires cross each other, pass out of letters or into cut-out boxes, they must be protected by porcelain or approved tubes or bushings.

11. Must have maker's name or trade-mark permanently attached to the exterior.

CURRENT NEWS AND NOTES.

THORIUM IN RUSSIA.—Advices from Yekaterinburg, Province of Perm, Russia, state that rich deposits of thorium have been discovered in an abandoned mine in that vicinity.

A UNION CONSPIRACY.—Advices from San Francisco allege that a conspiracy on the part of the Electrical Workers' Union to kidnap and murder P. M. McCarthy, president of the Building Trades Council, has been discovered and it is said the plot was revealed at a meeting of the council. Several of those involved are imprisoned. Developments of this affair will be awaited with interest.

N. E. L. A.—Mr. Dudley Farrand, chairman of the Convention Committee of the National Electric Light Association, has issued a very complete circular giving full data as to Washington hotels for the week of June 2-8. Headquarters are at the New Willard, but there are many other comfortable and convenient hotels, whose rates are quoted. A map is given of the city indicating their location and the principal buildings.

ILLUMINATING NIAGARA.—Effective use has been made from time to time of search lights at Niagara for illuminating the Gorge, etc. Citizens of Niagara Falls now propose to make a regular installation for the purpose, and Mr. W. D'A. Ryan, the illuminating expert, is giving his attention to the subject. At night Niagara is not seen except under moonlight, and it is believed that some very beautiful effects can be obtained by throwing artificial daylight on the scene, with color transitions.

SOUTHWESTERN ASSOCIATION.—The third annual convention of the Southwestern Electrical & Gas Association will be held at San Antonio, Tex., May 14, 15 and 16. A number of practical papers will be presented and the Question Box will brim over with practical experience. Entertainments will be given by the San Antonio Traction Company and the San Antonio Gas & Electric Company. The Sons of Jove will be on hand to add to the gayety of the occasion. Mr. H. S. Cooper, of Galveston, is the president, who wants each company in the territory to be represented by its management and heads of departments.

NEW YORK ELECTRICAL SOCIETY.—The New York Electrical Society held its 267th meeting at the power station of the Interborough Rapid Transit Company, Fifty-Ninth Street and Eleventh Avenue, Wednesday, April 24. Over 500 of the members and guests availed themselves of the opportunity of seeing this wonderful plant. After a short address by Mr. Henry G. Stott, superintendent of motive-power, the visitors were escorted by a corps of ushers over the station. A feature of the meeting which was highly appreciated was the presentation to each member by the Interborough Company of a pamphlet containing the principal dimensions and data of the plant. This, the first "visiting meeting" this year, was one of the most successful gatherings of the season. Thirty new members were elected.

OPENING OF ENGINEERS' CLUB.—The new building of the Engineers' Club, 32 West Fortieth Street, opposite Bryant Park, was opened to the members with a reception and housewarming on the evening of April 25, when some 1200 engineers were present. A dinner was given to the board and past-presidents at the adjoining New York Club by Mr. P. T. Dodge, vice-president. At 8 p. m. the board met in its handsome room in the new house, and Mr. W. H. Fletcher, chairman of the building committee, presented the new building to Mr. T. C. Martin, president, who accepted it in the name of the club. Commissioner Best then presented the club with a handsome stand of colors in the name of a number of old members; and the president, in the name and behalf of the board, presented gold watches to Superintendent Reynolds and Chief Engineer Sherman for loyal and efficient services. Music was performed in two parts of the house and a collation was served in the banquet hall. The bridge from the breakfast room and the passage door from the café to the Engineering Societies Building were opened for the first time, and a great many took the opportunity to include the two fine structures in their inspection. The housewarming was a delightful affair, everything went off without a hitch, and the evening will long be memorable in the annals of engineering hospitality in New York City. The total cost of the building, land, equipment, etc., is about $900,000, of which Mr. Carnegie, one of the oldest members, gave $450,000. His portrait by Butler has been set in the marble wall on the grand stairway, and on his return next fall from Scotland he is to be given a banquet. The architects of this beautiful and admirable clubhouse are Messrs. Whitfield & King, of New York City.

NEW YORK SUBWAYS.—At a meeting of the New York Rapid Transit Commission last week, President Shonts, of the Interborough system, submitted a letter in which he outlined the reasons why the Interborough did not bid on the Lexington and Seventh and Eighth Avenue subway lines. The report of the engineers says that the cost of building and equipping the proposed new lines would be approximately $88,000,000 for 39 miles of single track, as compared with the cost of the present subway at $71,000,000 for 63 miles of single track. This tremendous increase is due in part to the increased cost of materials and labor, but principally to the onerous conditions which would be imposed upon the contractor by the terms of the contract. The cost per mile of the new subway lines would be approximately $2,250,000, as against $1,130,000 per mile for the present system, or an increase of nearly 100 per cent. Taking into consideration the fact that the necessary money will cost more to borrow, the operating conditions will be more onerous and burdensome; the plant will be subject to taxation; the short term of the franchise requiring a greater depreciation charge per year; the unnecessary addition of cost of easements and the powers of supervision retained in the commission. Even if the city's credit were used for the entire cost of construction and the operating company only furnished the money for equipment, the new roads would not earn even the interest on the city's bonds. As an alternative proposition, the Interborough Company is prepared to enter into a contract for the construction at actual cost of the upper half of the Lexington Avenue route and the lower half of the Seventh and Eighth Avenue route, these to be joined to the present subway system at Forty-Second Street, thus making two complete longitudinal systems with a shuttle connection through Forty-Second Street. The Interborough would be willing to operate these additions upon a basis which would return only a fair rate of interest upon the money borrowed for equipment and without the prospect of any profit.

THE CLEVELAND ELECTRIC CLUB has moved its quarters to suite 718 Caxton Building, Cleveland. Mr. George L. Crosby is secretary.

HERTZIAN WAVE TORPEDOES are becoming quite familiar objects. A dispatch from Carthegena, Spain, of April 28, says that successful experiments were made there on that day in the explosion of torpedoes at long distances by means of the Hertzian waves system. The device was invented by a Spaniard named Balsera.

THE SONS OF JOVE.—The Chicago Jovian Club will give an operatic entertainment on May 16, at the Association Auditorium, 153 LaSalle Street, when a musical comedy will be performed. There will be 50 people on the stage, and an orchestra of 12 pieces. Tickets, $1 each, can be obtained from Mr. A. D. Blocker, secretary and manager, 139 Adams Street. A number of the Sons of Jove will participate, and their wives, relatives and other friends and enemies are expected to be present in large numbers to applaud all that is good and to sit silent the rest of the time.

BELL ON AIRSHIPS.—In an interview in London on April 28, Dr. A. G. Bell said: "My expectation is that an airship will be perfected capable of making 150 to 200 miles an hour. My opinion, however, is that the next step in aerial flight will take the form of such improvements as will make possible the creation of aerial battleships. The actual problem of the navigation of the air has already been solved by the Wright brothers. Naturally there will be development along commercial lines, a feature of which will be a great increase of speed, but the most attention will be paid to adapting airships to the purposes of war. My belief is that America will be the first country to perfect aerial battleships. This belief is based on inside information, and from the same source I get reliable statements on which I base my prediction of the early production of an airship of enormous speed."

EZRA CORNELL.—A celebration was held at Cornell University last week in honor of the one hundredth anniversary of the birth of Ezra Cornell, its founder, and pioneer of the telegraph industry. Mr. Andrew Carnegie had prepared an address, but was unable to go to Cornell to read it, owing to fatigue from the recent exercises in Pittsburg and New York. It was read in his absence and warmly applauded. In the course of it, he said: "Cornell was the most prominent man among the originators of consolidation. He had watched over the new invention in its infancy, supervised it during its growing youth and conducted it to maturity; was the largest stockholder in the Western Union, and one of the few millionaires then known. This was before the new species, the multi-millionaire, had made its appearance. His fortune, immense in those days, exceeded $2,000,000, all made out of nothing but hard work, speculation having no place in it. Cornell money was clean money, the reward of labor."

RIGHTS OF MUNICIPALITY.—The village of Swanton, Vt., will have to pay taxes to the neighboring town of Highgate on a water power privilege, according to an interesting decision just rendered by Judge Seneca Hazlton in the Franklin County Court. Swanton obtains the energy for its electric lighting plant from Highgate Falls. In a suit brought against the town of Highgate, Swanton claimed exemption from taxation on the ground that the purpose to which the property was devoted was a public one, and no tax could be legally assessed. The decision of Judge Hazlton, which is said to be the first on such a subject ever given in any court in the United States, says, in part: "The important question here is not as to the right of a municipal corporation to establish an electric lighting plant for the use and convenience of its citizens, but as to the right of a neighboring town to tax property within its limits. Whatever the law may be, the fair and equitable thing would seem to be that the town should receive taxes on property within its borders. A town which has valuable water privileges or quarries or ledges and such things regards their possession as a source of growth and development of private enterprises. Can a town be deprived of these natural advantages because a municipal corporation takes the place of a private enterprise?"

THE STUYVESANT THEATER.—New York is to have another new theater soon, called the Stuyvesant, on Forty-Fourth Street, to which Mr. David Belasco is applying his fertile mind. Perhaps the most interesting novelty in the new playhouse, however, is the system of electric lighting invented by Mr. Belasco and carried into effect by Nimis & Nimis, theatrical electrical experts. Mr. Belasco's idea has been to do away with the ordinary glare of theatrical lighting, so tiresome and injurious to the eyes, and to furnish a soft and gentle light like real daylight. No chandeliers or brackets will be visible in the theater. Instead, the clusters of electric lamps will be enclosed in the space between the fireproof roof of the building and a ground-glass ceiling of the auditorium. This ceiling will be of glass, supported by ribs, and thus presenting a paneled appearance. The effect of the light passing through the glass will be mild and all-pervading. The lamps beneath the balconies are to be similarly contrived. Behind the scenes for stage effects there are to be no less than 4000 lamps, with all manner of new contrivances for obtaining all degrees of brilliancy. The distance from the floor of the stage to the roof above is ninety-two feet. Above the stage are to be two large fly galleries on both sides. All the "drops," as well as the curtain, are to be raised and lowered by electric motors. The center of the stage is occupied by the platform of a large electric elevator, and below the stage are two separate floors. The purpose of this arrangement is to change the stage settings between acts more rapidly. One stage setting need merely be pushed on to the elevator and lowered to either of the floors below, where it can be stowed away. This electric elevator is controlled by two buttons. If one of these buttons is pushed the elevator descends to the first story below the stage, and if the other button is pushed it descends to the second.

LINCOLN AND TELEGRAPHY.—In the first of an intensely interesting series of articles on the United States military telegraph corps in the days of Lincoln, published in the May *Century*, Mr. David Homer Bates says: "Abraham Lincoln has been studied from almost every point of view, but it is a notable fact that none of his biographers has ever seriously considered that branch of the service with which Lincoln was in daily personal touch for four years—the military telegraph; for, during the civil war, the President spent more of his waking hours in the War Department telegraph office than in any other place except the White House. While in the telegraph office he was comparatively free from official cares and, therefore, more inclined to disclose his natural traits and disposition. During the last four years of Lincoln's all too brief public career, even until the day before his tragic ending, the writer was most fortunate in being able to see him and talk with him daily, and usually several times a day; for he visited the War Department telegraph office regularly, morning, afternoon and evening, to receive the latest news from the front. His tall, homely form could be seen crossing the well-shaded lawn between the White House and the War Department with unvaried regularity. In cool weather he invariably wore a gray plaid shawl thrown over his shoulders in careless fashion, and, upon entering the telegraph office, he would always hang his shawl over the top of the high screen door opening into Secretary Stanton's room, adjoining. This door was nearly always open. He seldom failed to come over late in the evening before retiring, and when returning to the White House after dark, he was frequently accompanied by Major Eckert, our chief, and nearly always by a small guard of soldiers. He sometimes protested against this latter precaution as unnecessary, but Secretary Stanton's orders to the guard were imperative."

CANADIAN TELEPHONY.—An investigation into the rates of the Bell Telephone Company of Canada has been ordered by the Dominion Government and will be started about the middle of May.

ENGINEERING CLASSIFICATION.—Bulletin No. 9, of the University of Illinois, Engineering Experiment Station, has for its subject an extension of the Dewey system of classification, the authors being Profs. L. P. Breckenbridge and G. A. Goodenough. The table of class numbers occupies 38 pages and 23 pages are taken up by the relative index, or list of subjects and their index numbers.

ITALIAN PRIZES.—The Reale Instituto Lombardo, of Milan, offers the Secco Comneno prize for 1911 for valuable researches on the physiological action of high-frequency currents. The same institution will award this month the Cagnolo prize of $500 and a $100 gold medal to the author of an acceptable paper on the discovery of radioactivity and its influence on modern physical and chemical theories.

ATLANTIC WIRELESS.—The Marconi Company is about to make some important developments in its wireless telegraphic system. It has arranged to install a special station at Clifden, on the west coast of Ireland, and by that means to establish a direct connection with the United States. Tests have already been made, and are said to have yielded satisfactory results. The system has in some important respects been improved upon, providing for a much more distant transmission. At Poldhu the etheric impulses are dispatched into space from a number of lattice work aerials. At the new station on the west coast of Ireland metal plates will be used instead of wires stretched over the lattice work.

OWNERSHIP IN BOSTON.—A blow to municipal ownership has been given by the Massachusetts Legislature when the House rejected the McNary measure, to authorize the city of Boston to construct or purchase an electric lighting plant, to light all public buildings and streets. The bill provided that the question should be submitted to the voters for acceptance upon petition of 2500 voters and after 30 days' notice. Senator Linehan's bill, embodying the same principle and providing that upon petition of 30 per cent of the registered voters in any city, the question should be placed upon the ballot and if affirmatively answered, should become law, was turned down in the Senate about the same time.

NEW YORK WATER POWER.—At Albany last week, Senator Fuller and Assemblyman O'Brian introduced by request a bill urging the State Water Supply Commission to devise plans for the progressive development of the water powers of the State for public use under State ownership and control. The commission is to adopt regulations governing the use of the water powers and prevent a monopoly thereof. It is to proceed at once to gather all possible information relating to these water powers, and to present a preliminary report to the Governor and the Legislature next January and a final report to the Governor a year later. The sum of $50,000 is appropriated. A statement given out in connection with the bill sets forth that it "was drafted for and in accordance with the views of the Committee on Forests of the New York Board of Trade and Transportation."

RUSSIAN TRADE.—Upon the initiative of Ethelbert Watts, the American Consul-General, a number of industrial representatives and members of the Consular Corps held a meeting at St. Petersburg last week to consider the establishment of a permanent international exposition of manufactures in the Russian capital. The Philadelphia Trade Museum has been taken as a model for the new organization. A committee, which includes the American, British, Spanish and Turkish Consuls, was appointed to formulate a project. The Consular representatives of Germany, Norway and Sweden, whose trade will suffer by increasing the facilities of importing from more distant countries, are flatly opposed to the plan, but Finance Minister Kokovsoff and Minister of Commerce Filossofoff have expressed full approval of it. Mr. Watts is presenting the matter to Washington.

CITIZENS VERSUS MUNICIPALITY.—The right of any or every municipality in the United States, and more especially in California, to own public utilities is the important point at issue in a case recently brought before Judge Olin Wellborn of the Federal District Court, Los Angeles. The suit is instituted as a test by the Edison Electric Company against the city of Pasadena to determine the right of the latter to buy the plant of the former. The electric corporation raises the contention that it is unconstitutional, under the fourteenth amendment of the Constitution of the United States, for a city to obtain such ownership. The claim is made that no municipality in this state may engage in competition with private citizens. because the California law provides immunity from taxation to cities, thus affording them an unfair advantage, in violation of the constitutional amendment referred to.

TELEPHONY IN INDIANA.—A meeting of the independent telephone men from the first, second and third districts, comprising northeastern Indiana, has been held to consider the proposition made by W. P. Sylvan and J. L. Putnam. sub-license agents of the Central Union Telephone Company. to retire from the local exchange business in Ft. Wayne, South Bend and other towns and cities in consideration of the independent companies giving that company the long-distance business on a percentage of the earnings, and divide the long-distance business in localities where the independents had long-distance lines, the latter to continue. The proposition provoked a warm discussion and developed an affirmative and negative sentiment. It was finally agreed that the matter was of so great importance that the state convention, composed of representatives from the entire state, should decide the matter. A resolution was passed declaring no company or district composed of companies should enter into such agreement until the state convention considered it, and that no such agreement should be entered into unless it applied to the whole state. This question will make the coming state convention the most important meeting ever held by the independent telephone people in the state.

HIGH-TENSION TRANSMISSION TOWERS.—Mr. D. R. Scholes, chief engineer of the Aermotor Company, of Chicago, gave a very interesting lecture before the Chicago branch of the A. I. E. E., Chicago, April 26. His lecture is not one which permits of abstract, as it was profusely illustrated with lantern slides showing different types of towers. To one who has not followed high-tension transmission work closely, and even to those familiar with it, the number of the lines using steel tower construction in the United States is surprising, as is also the great variety of designs used. Most of these designs, however, follow in general the windmill tower type of construction. A larger factor of safety is used in the transmission tower design than in windmill tower design, however, since a farmer could better afford to have a windmill tower blow over in the case of an exceptionally powerful hurricane than a transmission company could afford to have a length of transmission line go down. Mr. Scholes said that the high-tension transmission tower was a result of the high cost of copper. This had forced the use of high voltages, and high voltages in turn brought up the cost of insulators to a point where it became desirable to make these insulators as few in number as possible. In order to make them few in number it was necessary to use tower construction. The next Chicago meeting of the A. I. E. E. will be at the time of the high-tension transmission conference which is designed to get together engineers from all over the country at Chicago, May 24. The headquarters will be at the Auditorium Hotel, and meetings will be held in the Auditorium banquet room.

Generating Station of the Edison Electric Light Company of York, Pa.

THE plant of the Edison Electric Light Company, of York, Pa., is an interesting example of an old style installation, remodelled and enlarged which has discarded steam engines for motors as prime movers. The motors are supplied with electricity from the York Haven Water & Power Company, whose plant was described in the March 2 issue, and drive the entire plant.

The Edison Company, operating in a city noted for its large manufacturing plants and rapid growth, found a constantly increasing demand for its product. The capacity of the plant was steadily increased and three years ago there were 2100 hp in engines installed. However, progressive manufacturers were not backward in realizing the advantages of electric drive, the street railway system was expanding, and the city was adding to the number of streets as its population increased. The electric light plant was consequently under a heavy over-load and it became imperative for the company to do something to relieve the situation.

As the York Haven plant, 12 miles away, was nearing completion, the Edison Company decided to operate its entire plant with motors driven by electricity so cheaply generated at York Haven, and accordingly discarded enough engines to make room for the new equipment, retaining the other units for emergency work. The old switchboard, which consisted of a wooden frame work, was replaced by a modern marble board of latest design and containing many unique features for flexible control.

Nearly 3000 kw of new electrical machinery was installed; three of the old engines were retained. The company also operates an extensive American District Steam heating system, the exhaust steam from the engines, which were run non-condensing, having been used for this purpose. With the change from steam engines to motors, the steam heating system is now supplied with live steam. The franchise for pipe lines enables the company to operate in the most important sections of the city containing large stores and office buildings.

The electric light station is located at the corner of Park and Gas Avenue, as close to the center of the city as it is possible to get and yet have railroad facilities. The site is about 1000 ft. from the nearest point of the street railway tracks, and is well located so far as center of distribution is concerned. The boiler room adjoins the Northern Central Railroad, a spur track running into the boiler room. A large plot of ground adjoining the station provides ample storage facilities for coal. The building is of brick, with tile roof and wooden floor in the dynamo room, and is separated from the boiler room by a brick wall and iron doors. Owing to the shape of the plot of ground upon which the station is built, it was practically impossible to place the boilers and engines in the usual positions; that is, separated only by a fireproof wall to secure a short steam line. As a result a much longer steam line is necessary and, moreover, the layout is such that coal handling facilities were rather inconvenient, if not really expensive.

The feed water is obtained from the city water mains, and while this is fairly free from scale-forming ingredients, it has been deemed best to use a scale and corrosion preventive. This is known as "tri-sodium" and is injected into the feed water by means of a special pressure feed cup, similar to that used in feeding oil to a cylinder. The water is tested daily so that only the proper amount of preventive is used, and the scheme has given excellent results. A pipe line running to Codorus Creek provides an emergency water connection. The quality of this water, however, is very poor due to waste acids from several paper mills located above the power plant.

Prior to the change over from steam engines to motors, the station was very much crowded and in the space vacated by the discarded engines, motor-driven apparatus having an output three times as great was installed. The boiler room contains two 350-hp Climax boilers, each of which has four furnaces; a battery of two 300-hp Bromell water-tube boilers, built in York, and fitted with economizers located on top of the boiler setting and also provided with a motor-driven mechanical draft outfit, and one 350-hp Keeler water-tube boiler. All the boilers are hand fired. An open type feed-water heater serves all of the boilers and can be supplied with either exhaust or live steam.

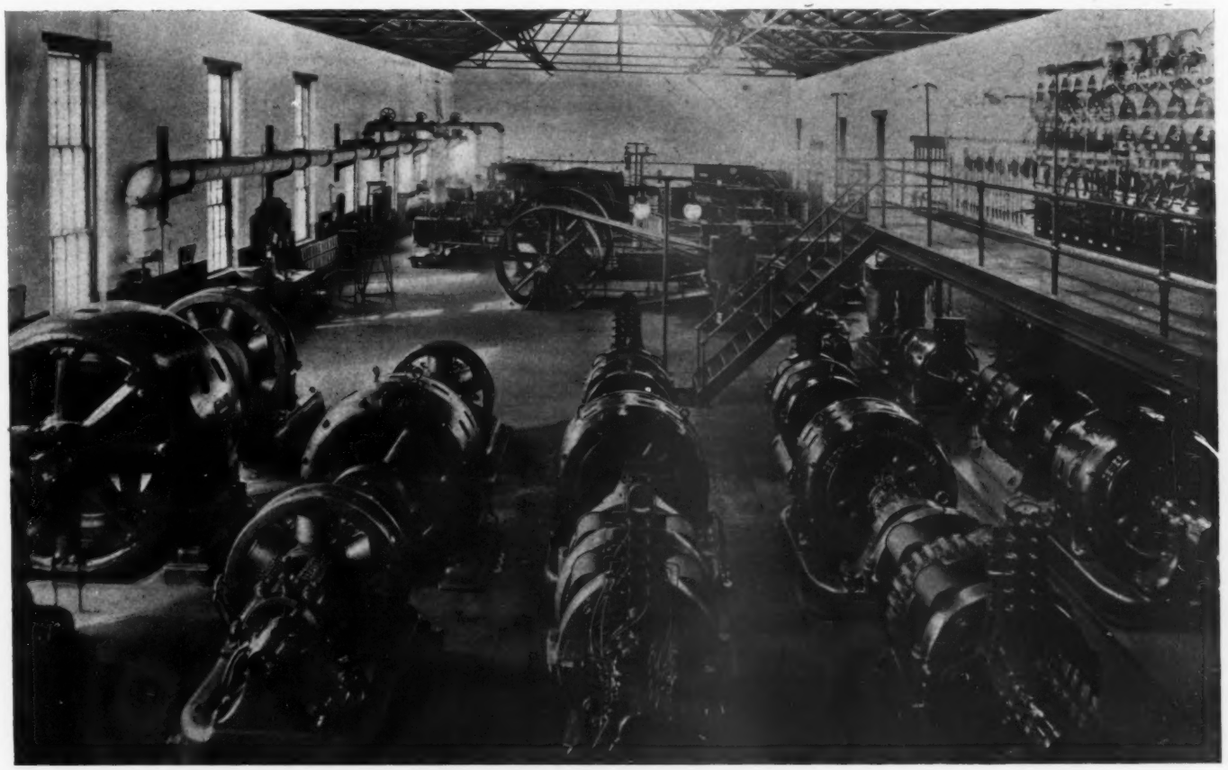


FIG. 1.—GENERAL VIEW OF DYNAMO ROOM, EDISON ELECTRIC LIGHT COMPANY, YORK, PA.

Two Snow and one Blake pump supply the feed-water to the boilers, the draft for the latter being controlled by an automatic damper regulator.

At present three boilers are kept under steam to supply the heating system. Recording steam gauges are installed in the

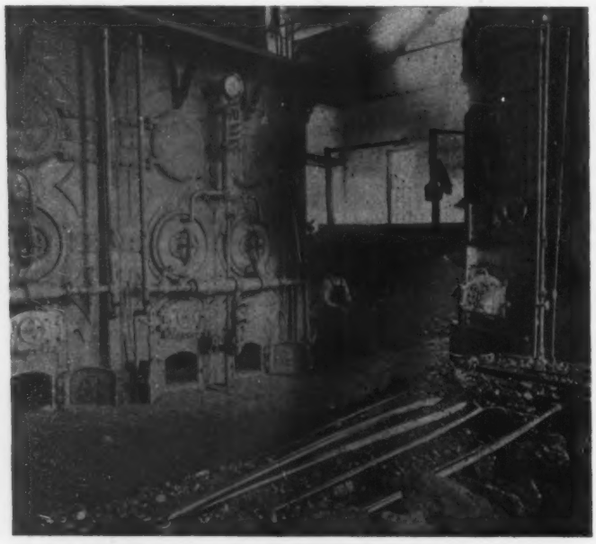


FIG. 2.—BOILER ROOM.

engine room, and the steam pressure carried for the heating system varies from 8 lbs. to 15 lbs. The old equipment retained in the engine room for emergency use consists of three Russell four-valve engines, as follows: One 450-hp tandem compound, belted to a 225-kw, 550-volt, direct-current generator, one 350-hp tandem compound, belted to two 100-kw, 550-volt Edison bi-polar railway generators, and one 350-hp simple engine, belted to a 60-kw, 125-volt bi-polar generator. A jack shaft is also driven through a clutch from this engine, and this shaft is equipped with two pulleys each carrying two belts, one over the other, and driving four 60-kw, 125-volt bi-polar boosters. One of the pulleys is equipped with a third belt running on top of the other two, and this belt is driven by a 200 kw synchronous motor which may be used in this way to drive the four boosters or may be driven by the single engine to furnish three-phase, 60-cycle, 2400-volt current to the alternating-current bus-bars. All the engines run at 145 r. p. m.

The new equipment, including the switchboard, was supplied by the General Electric Company. This comprises two motor-generator sets for the Edison three-wire system; a 600-hp, 2400-volt, three-phase induction motor with squirrel-cage rotor being direct-connected to two 200-kw, 125-volt generators. A similar set for light loads has two 100-kw generators direct-connected to a 300-hp induction motor. Owing to the speed of the large generators being above normal, it was found impossible to operate the two units in multiple and a special motor-generator set with a wide range of voltage to excite the shunt field winding of the smaller set was installed, and by proper adjustment the generators are now successfully run in parallel.

There are three 200-hp, three-phase, 2400-volt synchronous motors direct-connected to six of the latest type of Brush arc machines, which supply the electricity for the street and commercial arc lamps. These direct-connected units are all furnished with jaw clutches fitted with rubber cushions. For the railway system there are three 300-kw rotary converters with regulating transformers and two three-phase air-cooled transformers with motor-driven fan. A 100-kw, three-phase, 2400-volt synchronous motor with small belted exciter, direct-connected to a 60-kw differential battery booster controls a 264-cell, 1000 ampere-hour, Chloride Accumulator normally on the railway system. A similar battery is installed at Dallastown, about 12 miles distant. No booster is used in the latter place, the battery simply floating on the railway system.

The best of the old machinery taken out of the Edison station was put in an old Westinghouse plant owned by a separate company which operated in competition with the Edison Company, but which was subsequently taken over by the latter company. The equipment consists of four Motter return tubular boilers, two Putnam engines, old bi-polar railway generators and arc machines. This plant is only used in case of extreme necessity.

The new switchboard is made up of 48 panels and is quite complicated, considering that the tendency at present is toward extreme simplicity. The following description of the board, however, will show that every method is taken advantage of to make the units interchangeable. Indeed, it would take a very serious accident to cripple any portion of the service, so well is provision made for continuity. The city arc lamps and the commercial arc lamps are run on ten circuits, controlled by four panels of light marble, equipped with six Bristol recording ammeters. All switchboard panels pertaining to the railway service, including the batteries, are of black marble. Three panels control five 60-kw boosters connected to the suburban railway feeders. These are 125-volt machines and can be run two in series on the three-wire lighting circuits if necessary. These panels are fitted with astatic ammeters. Four panels control the suburban, and three panels the city, railway feeders. A totalizing railway panel is equipped with two large Thomson watt-hour meters measuring respectively the energy consumed by the city and suburban lines. Three panels control two 100-kw and one 225-kw railway unit which may also be used on the lighting system. The connections for these 550-volt machines on the 250-volt lighting feeders is interesting as well as very useful in emergency. The positive lead is connected to the positive side of the three-wire system, and the equalizer to the negative side, thereby leaving the negative lead open which also cuts out the series field coils. The shunt field coils are then excited with 110-volt current.

The rotary converters are also provided with switches allowing this arrangement of control. The switchboard panels are equipped with circuit breakers and ammeters, and three panels control the direct-current side of the rotaries. There is one large panel for the battery with a double-throw switch so that the battery may be used either on the lighting or railway circuits. This panel is equipped with a recording voltmeter, two

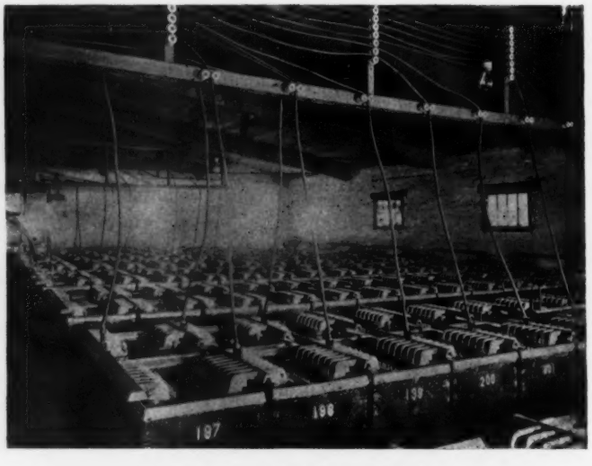


FIG. 3.—STORAGE BATTERY ROOM.

ammeters and a voltmeter. There are three panels equipped with two ammeters, polyphase watt-hour meters, starting and running three-point single-throw oil switches for the three synchronous motors driving the arc machines, and also three panels with ammeters, synchronizing plugs and receptacles, three-point, single-throw oil switches for the alternating-current side of the rotaries. These machines are brought up to

speed on the direct-current side and synchronized. Over the panels on a bracket is a General Electric synchroscope. The panel controlling the synchronous motor connected to the jack shaft is provided with synchronizing receptacles, since the machine may be used as a generator.

The incoming lines from the York Haven Water & Power Company's sub-station are connected to the 2400-volt bus-bars through two three-pole, single-throw oil switches equipped with overload time relays. This incoming feeder panel also contains two polyphase watt-hour meters, as the Edison Company maintains its own meters in addition to the York Haven Water & Power Company's meters located back of the board. The street railway and lighting loads are fed from separate bus-bars which may be tied together by a switch back of the board. There are two panels provided for as many induction motors, one of 600 hp and the other of 300 hp capacity, and each is equipped with a running switch. Four panels provided with stab switches control the 2400-volt feeders supplying the lamp and motor load for the small towns within a radius of 8 or 10 miles, and also for the parks. All these feeders have polyphase watt-hour meters connected to them at the back of the board. There are in addition a panel for the synchronous motor and battery booster, five panels for the three-wire lighting feeders, a panel for station lamps, a totalizing panel for the three-wire system, and two panels for the 200 kw and 100 kw generators. The neutral wire of the three-wire system is not brought to the board, the system running with a grounded neutral. Two three-phase feeders, each having six No. 0000 wires, two in multiple in each leg, and jumped together every fifth pole to insure proper distribution of current, transmit the electricity from the York Haven Water & Power Company's sub-station to the Edison plant. These feeders are provided at each end with Stanley air-gap lightning arresters of the indoor type.

The street railway system fed from the Edison station has about 65 miles of track. There are four suburban lines running respectively to York Haven, Wrightsville, Windsorville and Dover, with a trackage of 45 miles, the remainder being in the city limits. Each suburban line has two regular cars running on an hourly schedule, and there are thirteen regular cars operated on the city lines. The total motor equipment for street railways is about 1900 hp. The street railway company maintains four parks and conducts a number of picnics during the summer. Ordinarily the heavy load for the street railway system is about 1400 kw. In the near future there will be about 125 miles of suburban track laid.

The Edison Company's motor load is small, as the York Haven Water & Power Company supplies electricity to manufacturers in York. The incandescent lighting load is about 750 kw. The company operates 403 enclosed, 6.6 ampere, 500-watt arc lamps for street lighting on an all-night schedule at a rate of $52 per lamp per year. There are also 230 incandescent arc lamps and 98 commercial arc lamps, the latter for store lighting, connected to the system. The office of the company is situated on West Market Street, and includes the office of the York County Traction Company. A corner of the waiting room is partitioned off and used to display a limited line of household electric specialties, such as sad irons, heaters, cigar lighters, coffee percolators, etc. None of the articles is shown in actual use.

FIG. 5.—OFFICE OF THE EDISON ELECTRIC LIGHT CO., YORK, PA.

FIG. 4.—MOTOR-DRIVEN UNITS AND SWITCHBOARD.

The company employs one regular solicitor, and the general superintendent looks after important cases personally. Everything except the arc service is metered, the rate for lamps, motors, signs, etc., being 10 cents per kw-hour, with a sliding discount for prompt payment and for quantity used. The rate for large consumers ranges as low as 3 cents. Signs are furnished free with the understanding that they are to be used.

The company advertises to a limited extent in newspapers, on the back of street car transfers, and on blotters. The company also maintains an electric sign over the sidewalk in front of the office. The number of customers connected is about 200. No regular meter testing department is maintained; but on complaint meters are tested and all bills are carefully scrutinized and discrepancies immediately investigated and corrected. Flat irons are put out on 30 days' trial and finally sold at cost. Incandescent lamps are renewed free and no inducement is made for off-peak load or for 10-hour or 24-hour motor load other than the regular discount, as the station has ample machinery for carrying the heaviest loads. Moreover, the station is in reality a distribution station, and the ratio between load and expense does not increase as rapidly as in a steam-driven station operating on light loads. The officers of the company are as follows: F. B. Stewart, president; A. H. Heyward, vice-president; D. Young, Jr., general manager; J. E. Wayne, general superintendent, and W. H. Long, superintendent.

Automobile Garage and Repair Shops of the Philadelphia Electric Company.

The problem confronting an electric light company whose business demands that material be constantly distributed, and work done over a city with an area of approximately 130 square miles, is quite a serious one. Such a problem has confronted the Philadelphia Electric Company since its organization. Originally, there were a dozen or more distributing storerooms scattered about the city, where working gangs, horses and wagons were centered, and each storeroom was assigned a small district from which all the construction and maintenance work was directed.

This proved rather expensive, and plans were formulated for combining the working force, having in view the reduction of the number of men employed. The trouble and expense of maintaining horses and wagons where large hauls were required proved an insurmountable objection to this project, until the introduction of the electric vehicle, which made long hauls and therefore, consolidation, practicable. After careful consideration, it was decided to combine all the forces working on aerial lines with the machine shop and storerooms at one place, and also to establish in connection with the shops an automobile garage.

FIG. 2.—VIEW OF FRONT OF GARAGE.

A centrally-located site was selected where a garage was built with a capacity sufficiently large to accommodate all of the electric vehicles necessary. Immediately adjoining this, a building was erected to house the machine shop, an arc lamp repair shop and storerooms. Office quarters were provided for the accommodation of all the clerks, superintendents, etc., necessary for the construction and maintenance work, so that all the construc-

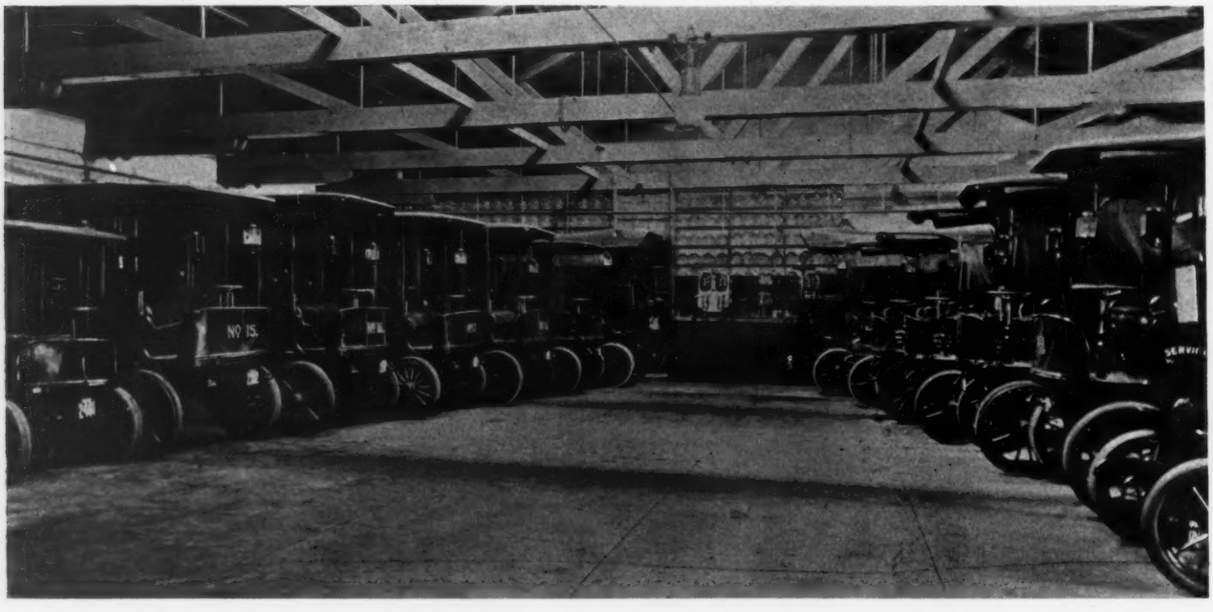


FIG. 1.—VIEW OF INTERIOR OF GARAGE.

tion and maintenance departments would be under one roof. This has proved a most economic arrangement, as the entire working force has been materially decreased, while at the same time much more work has been accomplished.

The most centrally located site available for the automobile garage was situated on the west side of Thirty-First Street north of Girard Avenue, and this was purchased. The property has a frontage on Thirty-First Street of approximately 120 ft. and extends back to the tracks of the Philadelphia & Reading Railroad, a distance of 157 ft. to the north and 86 ft. on the south; having a frontage on the Philadelphia & Reading Railroad of 140 ft. The front portion of the building is used as the garage, and on the railroad side is the building containing the storerooms, machine shop, arc lamp repair shop, etc.

FIG. 3.—RUNABOUT.

The garage building proper is one story high, and has a floor space of 120 ft. x 70 ft. A tool room 18 ft. wide is taken off the north end, and in this room are stored all the implements for the linemen, such as ladders, pike poles, etc. The room is also used for the distribution of carbons, globes, etc., to the arc lamp trimmers. On the south end a space 30 ft. wide is partitioned off for an office and motor-generator room, leaving a space 70 ft. x 72 ft. available for automobile storage. The auto-

FIG. 4.—ARC LAMP WAGON.

mobile room is paved with cement and is equipped with scales and hydraulic lift for batteries; has a section drained for washing wagons; has running hot and cold water and all the necessary apparatus for repairing batteries and tires.

A fireproof brick vault 7 ft. x 12 ft. is built inside the garage for the purpose of storing oils and combustible materials, thus reducing the fire risk. The corner of the room used exclusively for battery and tire repairs is shown herewith. Running water and large trays for washing the battery plates have been in-

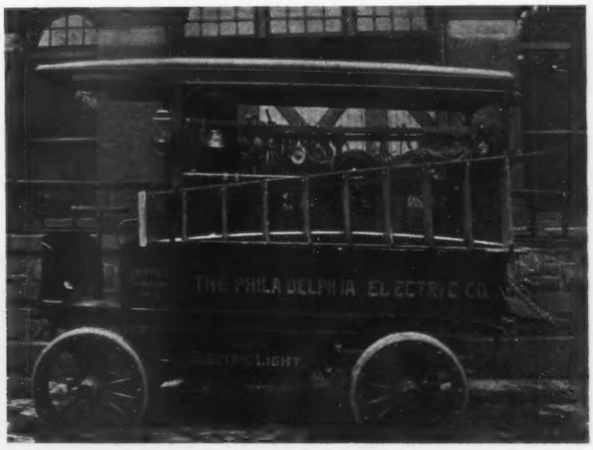


FIG. 5.—SERVICE WAGON.

stalled, together with a lead burning outfit, which enables the company to do all its own work, including the assembling of batteries. All of the latter are placed under the supervision of one man, who makes regular inspections and tests, so that should a battery show signs of weakening, it is immediately replaced by a duplicate, the old battery being repaired for future use.

Two motor-generator sets are used for charging all the vehicles. These have capacities of 20 kw and 30 kw, respectively. The smaller set consists of a 25-hp induction motor, direct-connected to a 160-ampere, 125-volt generator. A feature of this set is that the e. m. f. of the generator can be maintained constant at any voltage between 60 and 125 volts. The larger set

FIG. 6.—CONSTRUCTION WAGON.

consists of a 40-hp induction motor, direct-connected to a 250-ampere, 120-volt generator.

The switchboard is built in five sections. The first section controls the 20-kw set, and the fourth section controls the 30-kw set. The second section controls the charging stations from No. 1 to No. 5. Circuit breakers are installed on these feeders, so that they may be used for special tests. The third section controls charging stations No. 6 to No. 13. Double-throw switches are provided on all charging station circuits, so that each station may be supplied from either motor-generator set. The fifth section is used to control all the lamp and motor circuits in the station.

A feature of the garage is the method of charging the batteries in the vehicles. Charging stations are located at various points around the walls, and at each is a marble panel on which are

mounted two Thomson watt-hour meters and terminals protected by enclosed fuses for two sets of charging cables. Each station has a direct feeder from the switchboard furnishing current at from 60 to 125 volts. Two rheostats are placed back of each station panel, so that the voltage at each charging cable may be varied from 50 volts to full potential of the dynamo without varying the voltage at the dynamo. When charging small batteries, two of these are placed in series instead of each being charged separately.

Accurate records are kept which show the operating and maintenance cost and the distance traveled for each vehicle. This report is sub-divided into the following items: Batteries, Tires, Running Gear, Auto Station, Charging Current and Operating Wages. This provides a means for watching each vehicle

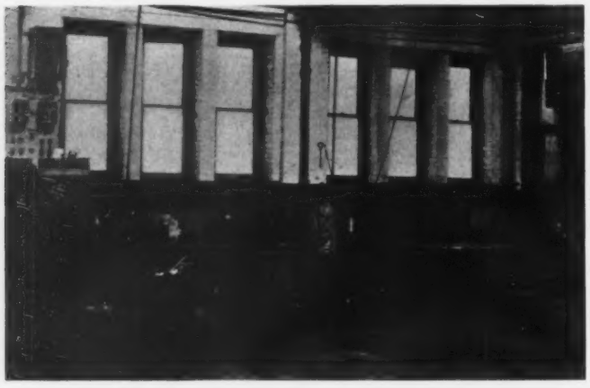


FIG. 7.—CORNER OF GARAGE FOR BATTERY CLEANING.

closely and also furnishes data for comparisons in cost between electrically-propelled and horse-drawn vehicles. In addition, a record is kept of each battery and each tire. Every battery crate and tire is numbered as soon as received and its entire history recorded, stating every vehicle on which it has been installed, the date placed in service, miles run, expense of cleaning, repairing, etc.

The automobile equipment at present consists of six runabouts, six lamp wagons of one ton capacity, six service wagons of one ton capacity, three construction wagons of three tons capacity

FIG. 8.—INTERIOR OF TOOL ROOM.

and one truck of three tons capacity. The runabouts are maintained for the use of the engineers of the company, and are very useful for making inspections, tours, etc., particularly in the suburbs.

The lamp wagons are used for distributing and changing arc lamps. The inside of the wagon is equipped with clamps and hangers to carry 30 arc lamps. Two men are sent out with each wagon; a chauffeur and a lamp changer. Under average conditions, 50 lamps can be changed each day. The wagons have a mileage capacity of 30 miles on a single charge.

The service wagons are used for light construction work, such as the installation of loops from pole lines to houses. Each wagon is equipped with a 30-ft. extension ladder and a full kit

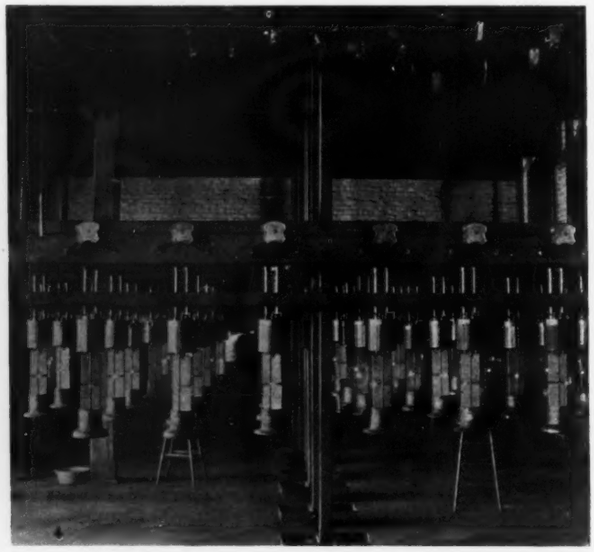


FIG. 9.—ARC LAMP TESTING RACK, SHOWING BROAD CARBON LAMPS.

of lineman's tools. A chauffeur and four men are sent out with each wagon, the latter also having a radius of action of 30 miles on a single charge. The construction wagons are used for heavy construction work. Each wagon is capable of carrying a crew of 10 men besides a chauffeur and foreman, and also a full equipment of line tools. The wagon has a radius of action of 25 miles on a single charge, which enables the construction department to cover large areas with each gang.

The three-ton truck is a most useful vehicle, since it can be utilized by all departments and for all kinds of work. The truck is equipped with an electrically-driven winch and pump, which has been used most successfully in connection with the underground work. Cables can be installed more rapidly and with less liability to damage by this means than when installed by hand, since the drawing-in speed of the electric winch is

FIG. 10.—LAMP REPAIR SHOP.

constant. A boom derrick has been constructed which can be attached to the truck and used for lifting iron and wooden poles into position. This in itself makes this vehicle very useful.

The three-ton truck is also used for hauling carbons, lamps, machinery, etc., from point to point. The platform of the truck

is very low, and by the use of the electric winch, heavy weights can be lifted into place with very few men.

The storeroom, machine shop and lamp repair shop are located in a five-story structure fronting the tracks of the Philadelphia & Reading Railroad; the third story connecting in the rear with the garage floor. The first three floors are given over for storage purposes; the stock carried including all sizes of line wire, cross-arms, iron arms, brackets, glass and porcelain insulators, all sizes of machine screws, arc lamp carbons, etc. In fact, all material required for aerial construction work and for general repair work in the shop is kept in stock. The facilities for handling material are very complete. Large bins have been erected with traveling ladders in front, making all the bins very accessible. A large elevator runs from the basement to the fifth floor and this is capable of carrying the largest reels of wire and cable handled. A railroad siding enters the basement, so that an entire freight car can be run into the building where platforms are located to facilitate rapid unloading.

The arc lamp repair shop occupies the entire fourth floor. Here all the arc lamps are repaired and tested. Twenty-five men are employed in this department; and an average of 75 arc lamps are repaired and tested daily. A view of the lamp room and test rack is given herewith. A number of broad-carbon, series, arc lamps are shown in the test rack ready for adjustment. These arc lamps are used for street lighting throughout Philadelphia.

The machine shop occupies the fifth floor. In this department all repairs to automobiles, switches and general machine work are done. The shop is equipped for small work and 45 men are regularly employed. One very desirable feature of the machine shop and lamp room is the splendid location. The view to the west is unobstructed over the Schuylkill River into Fairmount Park. All west winds, therefore, thoroughly ventilate and keep the shops cool. In fact, during the hottest days of summer, these rooms are always comfortable.

It is rather difficult to sum up the advantages gained from the consolidation of all the working forces. It should not be overlooked that this would have been impossible were it not for the use of the electric vehicle. To compare the relative expense of horse-drawn and electrically-driven vehicles is likewise difficult, as "cost per mile" is hard to obtain and "cost per hour" is unfair to an electric vehicle. By rating each horse as being able to draw one ton, 25 miles each day, and comparing the vehicles by their load carrying capacity, it has been found that the cost per month is practically the same in both cases. The hauling of a ton 25 miles each day, however, is beyond the capacity of a horse, and as this is well within the capacity of the electric trucks employed, the use of the latter results in considerable saving, aside from the savings resulting from the consolidation of the working force.

Central Station Improvements at Cincinnati.

The United Gas & Electric Company, of Cincinnati, now has under way an enlargement of its one central generating plant which will cause this plant to reach the limit of capacity possible to install on the site. The last unit to go in will be a 5000-kw Curtis turbine. Boilers to supply this will be equipped with Jones under-feed stokers with the speed of the motor driving the forced draft fan automatically controlled by the steam pressure. The largest generating units in the station up to the present time are a 300-volt, 2600-kw Bullock direct-current generator which is one of the largest machines of this kind ever built, and a 2600-kw, 4400-volt, three-phase, four-wire, 60-cycle generator. The older part of the station is filled with vertical engines each driving a direct-current and an alternating-current generator. The station has now grown to a size where there is no advantage—in fact, considerable disadvantage—in having such double-current units. The performance of this plant runs in the neighborhood of 25 lbs. of water per kw-hour or 5.9 lbs. of water per pound of coal and 3.9 lbs. of coal per kw-hour. Most of the output is generated by slow-speed compound condensing engines and the balance by medium-speed compound condensing engines. The load factor for 1906 (that is the ratio of average to peak load of the year) was 26.5 per cent. The peak for 1906 was over 8700 kilowatts, but of very short duration.

The company has purchased a site upon which to begin a new power plant on the Ohio River front. The Ohio River at Cincinnati has proved a puzzler for power-plant engineers for many years, because of its tremendous rise and fall, amounting to 70 ft. The difficulty of getting condensing water and coal to a small power plant on a river with such floods has prevented the erection of any electric power plant on the river heretofore. The problem for a large station has been very carefully studied out, however, by Mr. Fred Sargent, of the firm of Sargent & Lundy, consulting engineers for the Union Gas & Electric Company, and preliminary plans have been made which make feasible the operation of the power plant on the river front.

The company has established a new sub-station in the basement of its office building at Fourth and Plum Streets. In this sub-station are two 1000-kw Bullock motor-generator sets, receiving 4400-volt, three-phase current from the power plant and delivering direct current at a voltage which can be varied all the way from 240 to 380 volts. This extreme voltage variation is made possible by the use of the Thompson-Ryan field construction on the generator. Besides these two motor generators there is a "Chloride" battery of 150 H 65 cells in H 67 tanks. The tanks are enough deeper than the cells so that there is no necessity of cleaning out the active material to prevent the material which drops off from short-circuiting the plates in the bottom of the tank. This battery has a capacity of 4350 amperes on each side of the three-wire system. The electrical department of the United Gas & Electric Company is under the management of Mr. B. J. Jones.

Luminous Arc Lamps at Louisville, Ky.

The Louisville Lighting Company, of Louisville, Ky., is now making preparations to do the entire street lighting of the city of Louisville with magnetite arc lamps in place of the 9.6 ampere open carbon arc lamps with which it has heretofore been giving this service. There will be 2400 of these 4-ampere magnetite lamps, this being the largest installation of this type of lamp yet contracted for by any central station company. The precedent established at Louisville will be valuable to other cities and companies where a change to magnetite lamps is contemplated. One circuit of these lamps was installed on trial for about six months on one of the residence streets, namely, Third Avenue, south from Broadway.

The Commission of Public Works, after noting the illumination on this street as compared with that on the other streets of the city, fully approved and even urged the change from the 450-watt open carbon arc lamp to the 280-watt magnetite arc, the illumination of the streets being so much superior with the latter. The city makes its contract for street lighting with the company yearly, as under the law it cannot make a contract for more than a year. The price per year has been reduced from $84 to $74, but this reduction is due to the general downward trend of street lighting prices rather than to any recognition of the decreased wattage of the magnetite arc.

A careful examination of the lighting on Third Avenue as compared with that on other streets of Louisville was made one evening by one of the editorial staff of this journal. As would be expected from the light distribution curves of the magnetite arc lamp which have been published, the lamp lights a street much better midway between lamps and gives less light under and near the lamp than the open carbon arc lamp. This point is of great practical value because the very light area under each open carbon arc lamp makes the points midway between lamps seem very dark by contrast. This, added to the fact that the points between lamps with the open carbon

arc lamp are really not so well illuminated as with the magnetite arc, makes the practical results with the magnetite lamp far superior.

As a result of changing the street lighting system, very extensive and important changes are being carried on at the power station. The arc lighting plant is at present in a three-story building of very substantial construction of the old type, in which the engines were on the first floor. the line shafting on the third floor and the arc dynamos on the second floor. This old building is to be made into a boiler room, and in a new part of the building adjoining thoroughly electric modern generating equipment is being provided. Two 3000-kw Westinghouse turbo-generators are now being installed. These will generate at two-phase, 2300-volts. The boiler capacity for the turbines will be 4800 hp. In the generating room will be 48 mercury arc rectifier sets, each designed for a circuit of 50 magnetite arcs. For every two rectifier sets there will be one transformer and regulator to supply it; the transformers and regulators being arranged for two circuits each. It will be therefore necessary to keep approximately the same number of lamps on each circuit supplied from the same transformer. Each transformer regulator and pair of rectifiers are to form one of a series of units to be installed in a long row on a gallery provided for the purpose.

The power plant operates condensing, although it is not anywhere near a river. The water is taken from large wells and the flow is abundant for ordinary condensing purposes. A cooling tower is to be installed for use during peak loads. The last well constructed is 25 ft. in diameter and 65 ft. deep. In the bottom of this well are driven a lot of 8-in. pipes to depths varying from 5 ft. to 35 ft. These are all connected up to the suction of a Worthington centrifugal pump with vertical shaft which raises the water to the condensers. All the boiler water has to be softened to avoid very bad scale. A large We-fu-go water purifying plant has been erected with settling and mixing tank for treating the water with lime and soda ash to precipitate the scale-producing solids.

Another interesting change that is going on is the establishment of a fireproof sub-station in the heart of the business district which will supply low-tension alternating current. The company at present has both alternating and direct-current 110-volt service in the downtown district. It also supplies 500-volt direct-current motor service. The plan is to place all the wires underground in the downtown district and at the time of making this change. all the lighting service will be changed from direct to alternating current, single-phase, the sub-station serving as a distributing center for low-tension, three-wire, single phase feeders. At this sub-station also a 500-volt direct-current synchronous motor generator set, of 1200-kw capacity, with a two-phase 2300-volt motor is to be used for giving 500-volt motor service. This will enable the removal of a great amount of 500-volt circuit copper between the power house and the downtown district, which are about a mile and a half apart. The downtown sub-station will feed underground a district of about ½-mile radius. Between the sub-station and the power station at 14th Avenue and Magazine Street, there will be four 2300-volt two-phase feeders. From the sub-station twenty 125-250 single-phase distribution feeders of 300 kilowatts each will run out. The situation is an unusually interesting one, as a single-phase, low-tension lighting distribution from a sub-station in a downtown district of a large city is seldom found. The possibility of distributing through the business district at a primary voltage of 2300 and placing step-down transformers in manholes and vaults was considered. but the fact that the district to be covered is so small led to the adoption of the single sub-station plan, thus avoiding troubles with underground transformers.

The work is being carried on under the design and direction of Mr. G. W. Hubley, superintendent and chief engineer of the company. When completed, the Louisville Lighting Company will have a very modern plant.

Central Station Notes from Marysville, Ohio.

The Marysville (Ohio) Light, Water and Ice Company was the second central station to adopt the magnitite arc lamp in the United States. This was about two years ago, and at present there are 66 magnitite arc lamps on the streets, the rate for energy being $67 per year. The first lamps installed being of the form first commercially brought out, were naturally somewhat of an experiment and were replaced with a later type in the summer of 1906. These latter have given practically no trouble. They are burned on a 6.6-ampere series arc circuit supplied from a Brush type arc dynamo, the voltage at each lamp being about 70. These lamps were installed in place of 10-ampere Thompson-Houston open arc lamps. It is hardly necessary to say to those familiar with the efficiency and light distribution of the magnitite arc that the streets of Marysville are very much better lighted than they ever were before. Marysville has a population somewhere between 3000 and 4000 and with 66 arc lamps is naturally much better lighted than are many towns of that size.

Over most of the city these arcs are placed about a block apart, which results in excellent illumination along all points of the street. The color of the light is very similar to that of the open arc lamp. There is not nearly so much contrast between the light under each lamp and the light midway between as with other arc lamps. Not only is the actual illumination midway between lamps better, but it is easier to see one's way along the street because there is not so much contrast between the points near and midway between lamps. All familiar with the magnitite arc know this to be theoretically the case, and a trip around the streets of Marysville at night fully demonstrates the practical value of this advantage.

The upper electrode on these lamps is a heavy piece of copper. The lower electrode is composed of magnitite or the black magnetic oxide of iron rammed into a sheet steel tube. The magnitite electrode is fed up from below. The upper electrode (which is of copper) keeps a fixed position, and consequently it is possible to use a flat reflector about at the level of the arc, which greatly aids in distributing the light in directions useful for street lighting. Because of the varying position of the arc in ordinary carbon arc lamps, it is not possible to place a small reflector where it will do as much good as the small reflector on the magnitite lamp. The lamp has a chimney for carrying away the fumes from the arc. The first magnitite electrodes were uncertain in density and consequently uncertain in light. The present electrodes are very uniform and burn 186 hours with one trimming. This makes it possible to get along in Marysville by trimming once a month. They are operated on a moonlight schedule from dark until 1 a. m. The magnitite electrodes cost 5 cents each. A little trouble is sometimes experienced in starting up a circuit of these lamps, but after a circuit has been closed a few moments, all of the lamps can usually be started by "flashing" the dynamo once or twice. The management of the company ascribed this trouble more to lack of care in cleaning the lamp clutches than to any inherent defects of the lamp. The company also operates under very trying conditions as to grounding the circuits through tree limbs; it is difficult to trim trees enough to keep them clear of the lines, and most of the residence streets are well provided with trees. This, of course, is not altogether conducive to satisfactory lamp operation, whatever the lamp used.

COMBINED WATER, ICE AND ELECTRIC PLANT.

The company owns the water works system and also operates an ice plant from the same boilers that supply the electric plant. The electric plant has two 75-kw 110-volt, direct-current generators direct-connected to a high-speed vertical engine, two 35-kw and two 25-kw belted generators, making a total of 270 kw, besides an arc dynamo. Adjoining is a 12-ton ice plant. A boiler equipment sufficient to carry the winter peak load on the electric plant is enough to operate the ice plant in addition to the other plants in summer, so that no extra investment in boilers has to be carried because of the ice plant.

DEVELOPMENT OF THE LOAD.

The management of the company has been much more enterprising than the average, as can be seen from the fact that figuring the population on the 1900 census, the gross earnings are about $5 per capita for the electric part of the plant. Thirty-five motors or more than 1 motor per 100 inhabitants are connected, not including numerous small fan motors and other motors of small capacity doing light work in residences. One very interesting development is the use of ¼-hp motors in residences for driving several different kinds of machinery. These motors are belted up to a short lineshaft and are used

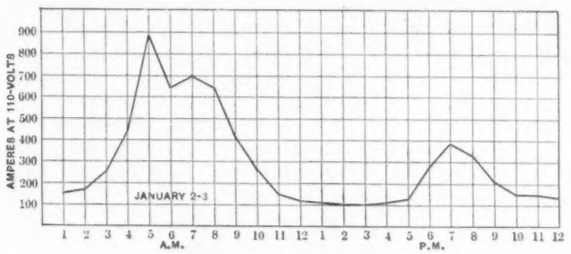


FIG. 1.—MARYSVILLE LOAD, EXCLUSIVE OF STREET LIGHTING.

to run the washing machine, wringer, ice-cream freezer or anything else requiring power. It is considered more convenient to have the motor driving a lineshaft in this way and bring the machines to the shaft than to shift the motor around among the different machines it is to drive.

The company began to introduce electric irons long ago, before other central station companies began to wake up to the value of the electric iron as a revenue-producer. As a result, it now has out among its customers 270 irons. Free lamp renewals are given. Some tantalum lamps have been introduced in the stores, and also in the outlying residence districts where the voltage regulation is not very good. The rates for lighting are 12 cents per kw-hour, less 10 per cent if paid within 10 days. The minimum bill is $1. There are no discounts for long-hour users. There is some competition from gasoline installations, there being about six in the down-town district, principally for long-hour use. The energy rates for motors are as follows:

200 kw-hours or less	7	cents.
200-300 kw-hours	6	cents.
300-400 kw-hours	5½	cents.
400-800 kw-hours	5	cents.
800 up	4½	cents.

The output for February, 1907, was 21,741 kw-hours for the low-tension circuits. Fig. 1 shows the 24-hour load curve on the low-tension, direct-current circuits from noon, January

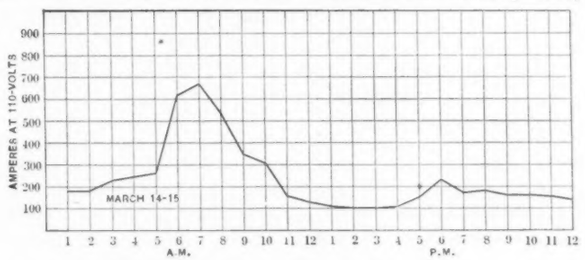


FIG. 2.—MARYSVILLE LOAD, EXCLUSIVE OF STREET LIGHTING.

2, to noon, January 3. Fig. 2 shows the load curve from noon, March 14, to noon, March 15, illustrating medium conditions.

ARCHES ON DOWN-TOWN STREETS.

There is one principal corner in Marysville from which business streets radiate in four directions, and most of the business houses are located within one block of this corner. About seven years ago the city put up four arches at the four approaches to this corner, these arches being located about half a block from the corner. The arches consist simply of six, four and three-inch iron pipe, bent to shape. Underneath each arch is a strip of wood on which 25 16-cp lamps are placed. The arches are lighted only on Saturday night and the city pays $200 per year for the 100 lamps. In addition to the strip of wood, a kind of sheet iron trough or protector has been put over the lamps, but this is a mistake, as it serves principally to hide the lamps at the present time, having been bent down by various decorations which have been hung on the arch from time to time. The decorative and lighting value of the arches has thus been almost entirely destroyed. The general plan, however, is an excellent one, and the materials for making such pipe arches are at hand in almost every village. They can be bent up in a local shop, and offer a simple solution of the question of providing neat, decorative street lighting, which is being considered in many places at the present time.

The Marysville company is under the management of Mr. George P. Zwerner.

The Legal Requirement of Novelty in Inventions.

Under that section of the United States Patent Act which provides that "any person, who has invented or discovered a new and useful art, machine, manufacture," etc., may obtain a patent therefor, it will be apparent that, to be patentable, the thing claimed to have been invented must be novel. Novelty is essential and if it is lacking in a given device a patent thereon is not properly issuable. In the language of the opinion in the case of Smith vs. Elliott, 9 Blatch. (U. S.) 400, the law "gives no monopoly to industry, to wise judgment, or to mere mechanical skill in the use of known means, nor to the product of either if it be not new." Articles of manufacture may be new or novel in the commercial sense when they are not new in the sense of the patent law. A definition of the word "new" as used in the patent act or of the word "novel" which is generally substituted for it, would lend but little assistance in determining whether or not a particular device is patentable. But considerable light can be thrown upon the matter by referring to the facts and holdings of a few of the vast number of decisions which have turned upon a construction of this section of the patent act. To say that a certain device does not possess novelty is merely another way of saying that the device has been anticipated. Where the article for which a patent is sought has been made before in precisely the same manner it must be clear that the article does not possess novelty. It has been anticipated and is not, therefore, entitled to the protection of the patent act. But cases wherein the old device and the new one are identical are of rare occurrence. However, it not infrequently happens that a patent is applied for upon an article or device, which differs but slightly from some other device that has been used or patented before, and the questions then presented are whether the difference is sufficient to characterize the later device as novel and whether the production of the difference involves the exercise of invention.

Section 4886 of the patent act, after making novelty one of the requirements to the right to obtain a patent, proceeds to enumerate what will anticipate a device so as to render it nonpatentable. Thus, it provides for the issuance of a patent to one claiming to be an inventor only where his device has not been "known or used by others in this country before his invention or discovery thereof." And under this provision want of patentable novelty has been held to have been shown by establishing a single prior use in this country. Brush vs. Condit, 132 U. S. 48. In the case just referred to it appeared that one Charles F. Brush had brought an action to restrain the infringement of a patent granted to him for "improvements in electric lamps." The invention related to a device for use in arc lamps, "whereby the carbon sticks usually employed are automatically adjusted and kept in such position and relation to each other that a continuous and effective light shall be had without the necessity of any manual interference." The defense was that the plaintiff's patent was invalid for the reason

that the device in question had been previously used in a lamp invented by Charles H. Hayes, of Ansonia, Conn. Although but one Hayes lamp was made and that one used only for a period of about 10 weeks, it was held to have been an anticipation of the plaintiff's device and the plaintiff's patent was, therefore, void. In the case of Simmonds vs. Morrison, 44 Fed. Rep. 757, also an action to enjoin the infringement of a patent, the patent in question covered a detachable dash rail, intended to be attached to leather-covered dash boards of carriages by means of clamps. One of the defendant's contentions was that the plaintiff's patent was void for anticipation and that, therefore, the plaintiff had no standing in court. In support of this contention the defendant testified that about 12 years before the issuance of the plaintiff's patent an apprentice boy brought to his (the defendant's) shop a covered carriage dash board with orders to put a rail on it, and that he constructed a rail and fastened it to the dash board in precisely the same manner as outlined in the plaintiff's patent. Though this was the only detachable rail ever made by the defendant until after the plaintiff had secured his patent, it was held that the making of it was a complete anticipation of the plaintiff's patent and that the patent was, therefore, invalid.

It is provided in the patent act, section 4925, that whenever it appears that a patentee, at the time of making his application for a patent, believes himself to be the original and first inventor or discoverer of the thing invented, "the same shall not be held to be void on account of the invention or discovery, or any part thereof, having been known or used in a foreign country before his invention or discovery thereof, if it had not been patented or described in a printed publication." So, where it is claimed that a particular patent is invalid on account of the patented article having been in use prior to the patentee's invention, it must appear, in order to substantiate the claim, that the article was used in this country. The fact that the patented article was extensively known and used in a foreign country prior to its discovery by the American inventor will not affect the patentability of the invention, where the conditions concur that the patentee believed himself to be the originator of the device and the device had not been patented or described in a printed publication. This provision of the patent act was brought into the case of Morse vs. O'Reilly, 15 Howard's Rep. (U. S.) 62, decided in 1853, in which the inventor of the electromagnetic telegraph, Prof. Samuel F. B. Morse, brought suit against Henry O'Reilly and others to enjoin them from using a telegraph line which they had erected between Louisville, Ky., and Nashville, Tenn., and were about to extend to New Orleans. In the report of the case is a history of the invention in which is described a discussion concerning the affinity of electricity to magnetism and their probable identity, which took place on board the packet ship "Sully" on her passage from Havre, France, to New York, in 1832, and in which the inventor, Hon. William C. Rives, Minister of the United States to the Court of France, and other gentlemen of extensive reading and intelligence engaged. According to statements there made it was in the course of this discussion that Prof. Morse first conceived the idea of communication by means of electricity. Mr. Chief Justice Taney, of the Supreme Court of the United States, delivered the opinion of the court, in which he graphically refers to the struggles of the inventor to reduce his discovery to practical use and the unremitting ardor and industry with which he pursued his investigations over a period of several years in the face of great pecuniary embarrassment, until the appropriation by Congress in 1838 of $30,000 to test the utility and practicability of the invention and the final granting of the American patent in 1840. It was interposed as a defense by O'Reilly and his associates that Prof. Morse was not the true and original inventor of the telegraph; that he was subsequent in point of time to Dr. Steinhiel, of Munich, Germany, who communicated his discovery of a magnetic telegraph to the Academy of Science in Paris in 1838, stating in his communication that he had had a telegraph line in operation for more than a year; and that Prof. Morse was also anticipated by Prof. Wheatstone, of London, and by Edward Davy. It is rather surprising that four different magnetic telegraphs, each purporting to have overcome the difficulty arising from the fact that the galvanic current, however strong in the beginning, was found to become gradually weaker as it advanced on the wire, and was not strong enough to produce a mechanical effect after a certain distance had been traversed, should have been made public so nearly simultaneously that there should be doubt as to which was entitled to priority. It was held, however, that the facts disclosed that the telegraph of Prof. Morse came before those of the other inventors mentioned. But this was not necessary to the validity of Prof. Morse's patent or his right to restrain infringement by the defendants, for, said the court, "if the priority of Morse's invention was more doubtful and it was conceded that in fact some one of the European inventors had preceded him by a few months or a few weeks, it would not invalidate his patent. The act of Congress provides that, when the patentee believes himself to be the first inventor, a previous discovery in a foreign country shall not render his patent void, unless such discovery, or some substantial part of it, had been before patented, or described in a printed publication."

Exciter Troubles.

By A. E. Buchenberg.

ELECTRICAL central station operation can be successful only upon the basis of accurate knowledge of the construction and characteristics of the electrical apparatus, a familiarity with the cause and cure of troubles which may occur, in connection with intelligent care and operation. Since the uninterrupted and satisfactory service of the alternator depends in a considerable measure upon the proper operation of the exciter, this part of the station apparatus is entitled to the attention and care which its importance demands.

In the following article the writer has attempted to take up in the form of a diagram and general discussion a number of the difficulties and troubles which may arise in the operation of direct-current machines when used as exciters for alternators. While necessarily incomplete it embraces the more common troubles, and it is hoped may be of some service to central station men in a systematic search for and determination of causes, and the application of an effective remedy.

For convenience of discussion all exciter troubles may be classified under heating, sparking, voltage variation, and failure to operate.

Armature Iron.—Excessive heating of the armature iron may be caused by the increase of iron losses due to higher magnetic flux densities occasioned by low speed or high voltage. In the case of an exciter armature mounted on the alternator shaft, low exciter speed must obviously be due to a low alternator speed, and the heating is aggravated by the increased alternator excitation required under these conditions, in addition to the less effective ventilation at the lower speed. In the case of separately driven exciters from an engine or water wheel, the speed of an exciter may be low from a variety of causes, such as overload, belt slippage, drop in speed with load, etc. When the exciter is belted from the alternator, low speed may be due to incorrect ratio of exciter drive pulley and exciter pulley, excessive exciter belt slippage due to a greasy or loose belt, or low alternator speed.

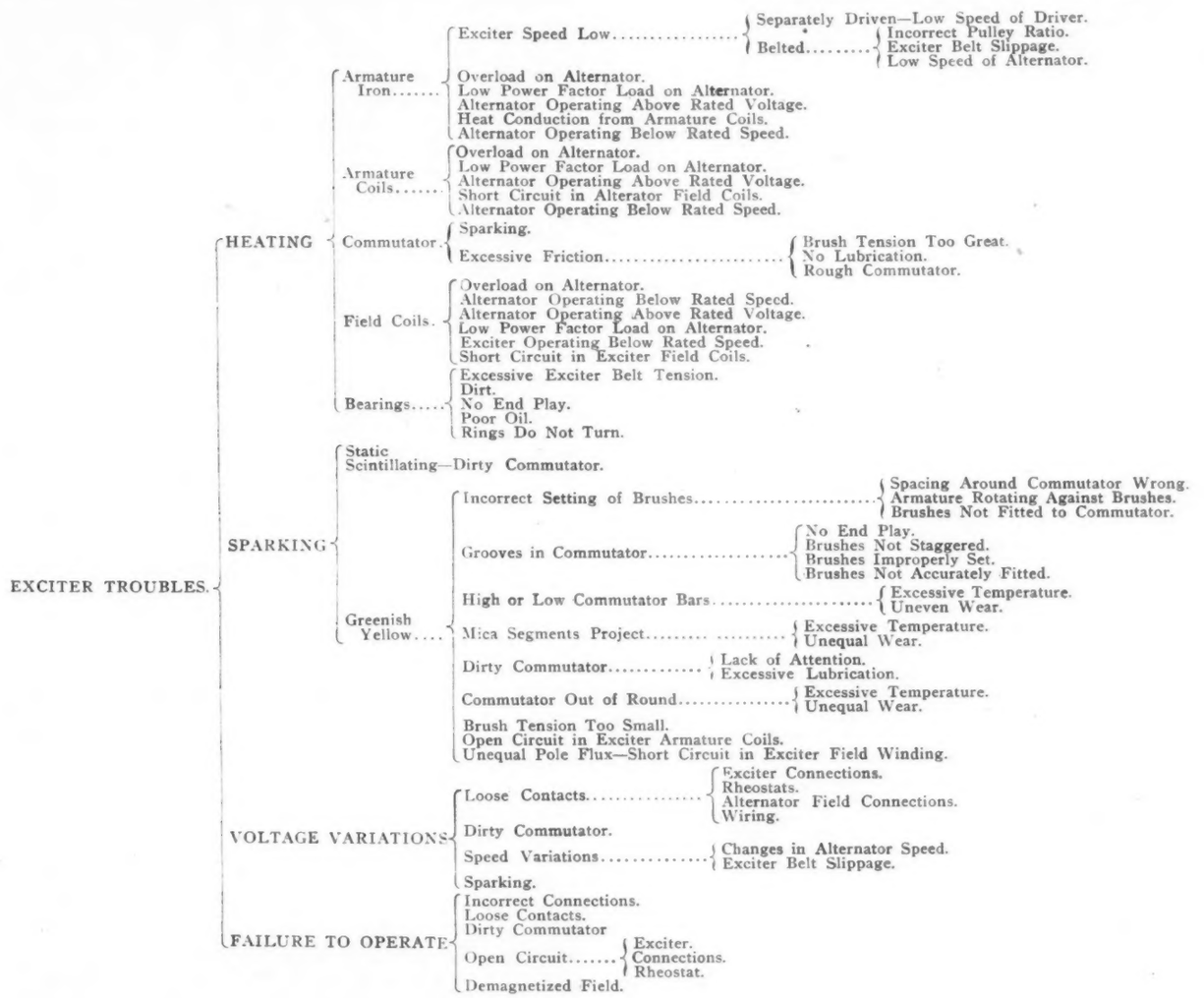
High temperatures in the armature iron may also be caused by the increase of exciter voltage required by an excessive overload on the alternator, the operation of the alternator above normal voltage, below rated speed, or on a very low power factor load.

Another cause of excessive temperature rise in the armature iron may be in allowing all or a considerable portion of the alternator field rheostat to remain in circuit, with a consequent increase in necessary exciter voltage. This, of course, holds true only where alternators are operated from individual exciters and both an exciter field rheostat and alternator field rheostat are used. The above is worthy of mention from the fact that many station operators lose sight of the function of the series rheostat under these conditions, and where no volt-

meter is connected to the exciter or lamps operated from it, the voltage is sometimes forced to extreme limits from this cause. High temperature rises in the exciter and series rheostat are the result, in addition, to a needless and wasteful dissipation of energy in the alternator field rheostat.

Armature Coils.—High temperature rise in the exciter armature coils may be due to an excessive overload on the alternator, an unusually low power factor, or the operation of the alternator above rated voltage or below rated speed. All the above conditions necessitate an increased output in exciting current, and while exciters are always supplied of a capacity to properly take care of reasonable variations from normal operating conditions, they cannot properly take care of such extreme conditions necessarily increased shunt-field current, an excessive overload, a low power factor load on the alternator, or the operation of the alternator above rated voltage or below rated speed. A partial short-circuiting of the exciter shunt-field winding will necessitate an increased field current to compensate for the turns rendered ineffective, with a resultant increase of temperature rise.

Commutator.—Excessive heating of the commutator may be due to sparking, as a large per cent of the heat of the spark is absorbed by the copper of the commutator. Other causes are excessive friction from heavy brush tension, no lubrication, a rough commutator, or a heavy current overload. Any one of the above causes or the combined effect of several may cause



as are sometimes encountered, especially among the smaller installations. In any instance of overheating of the exciter armature coils the above points should be investigated.

A partial short circuiting of the alternator field winding demands an increase of exciting current approximately proportional to the percentage of the total number of turns rendered ineffective from this cause, and results in an increased heating of the exciter armature coils. The most convenient way of testing for a short-circuit in the alternator field winding is to pass direct-current through the field coils and note the drop of voltage across the terminals of each coil. This drop should be the same in each case, and a smaller drop through one or more coils is an indication of decreased resistance due to internal short-circuiting.

Field Coils.—High exciter field-coil temperatures may be caused by operating the exciter below its rated speed with a the commutator to reach a temperature at which the solder used on the armature coil lead connections will be melted and thrown out. The cause of high commutator bars or mica segments and of a commutator out of round can very often be traced to excessive heating.

Bearings.—Heating of the exciter bearings may be caused by grit, dirt, or cinders in the bearings or oil wells, excessive tension of the exciter belt, or the use of a poor grade of oil. The oil rings may have become bent or cramped so that they do not turn. If there is no end play, grooves may in time be cut in the journals, bearings, or both, and result in heating.

Sparking.—Sparking at the brushes is by far the most prevalent and annoying trouble experienced in the operation of exciters, and on account of its deleterious effect upon the entire station operation its causes, effects and cure will be gone into in considerable detail. All sparking may be classified into three

general forms, namely: Static sparking, scintillating sparking, sometimes called "ring fire," and greenish-yellow sparking. The small bluish white sparks sometimes noticeable are not at all harmful beyond a slight heating effect. They are of the same nature as the static discharge from a moving belt, and the small amount of current ruptured in the air has no appreciable destructive effect upon the commutator. The second class of sparking which is sometimes evident as a partial or complete ring of fine scintillating sparks around the commutator, is not to be considered as a true sparking. It is caused by dirt or small particles of carbon worn from the brushes being brought to a temperature of incandescence while under the brushes, and remaining at a white heat while passing from one set of brushes to another. While not being particularly harmful beyond the heating effect upon the commutator, the increase of brush contact resistance from this cause is entirely unnecessary and should be avoided. This condition is invariably due to a dirty commutator, and the remedy is to clean thoroughly the commutator with a clean, dry cloth free from lint. The third or greenish-yellow variety of sparks are always and distinctly harmful on account of the heating and the more or less rapid destruction of the commutator segments, in addition to the serious effect upon the proper operation of the exciter and alternator. Every effort should be made to locate the cause and remove it immediately upon the appearance of such sparking, as delay only aggravates the difficulty and will in time lead to serious trouble.

If the rocker arm, shifting mechanism or brush-holder studs are allowed to work loose, a variation of brush tension or area of brush contact will result, with a consequent chattering and sparking.

Sparking may result from an incorrect setting of the brushes in relation to the proper alignment of the brush tips, or to the unequal spacing of the several sets of brushes around the surface of the commutator.

If the commutator rotates "against" the brushes instead of "with" them, a slight inequality in the commutator surface may cause chattering and sparking.

Sparking may be caused by not accurately fitting the rubbing surface of each brush to the surface of the commutator. Neglect of this precaution may considerably reduce the brush contact area, or may cause the brushes to bear only on the "toe" or "heel" with resultant heating and sparking troubles. The proper fitting of brushes to the commutator is most conveniently and accurately done as follows, while the machine is not running: Cut strips of fine sandpaper a little wider than the width of the brushes and pull them between the fingers to give the smooth side of the sandpaper approximately the same curvature as the surface of the commutator; raise one brush slightly and push a strip of the paper under it sanded side up; keeping the end of the strip against the surface of the commutator, draw it forward in the direction of rotation of the armature while the brush is firmly pressed down upon it with the other hand. The brush must be raised each time the sandpaper is pushed back for a new pull to prevent rounding off the brush tips. Under no circumstances should emery cloth be used.

Grooves in a commutator may be due to a lack of continuous end play of the exciter shaft in the bearings, the brushes may not be staggered to distribute the mechanical wear evenly over the entire active commutator surface, or an incorrect fitting of one or more brushes to the commutator may result in gouging and cutting. In the case of a grooved commutator the wearing surfaces of the brushes, of course, conform to the commutator, and any spasmodic end-play will greatly reduce the contact area on account of the "climbing up" of the brushes, and sparking will result. The remedy is to locate and remove the cause of the cutting, true up the commutator in a lathe, and obtain continuous end play.

High or low commutator bars are a prolific source of sparking troubles on account of disturbances of brush contact conditions. In the case of high-speed exciters the brushes may be thrown slightly away from the commutator from this cause and vicious sparking will result. High bars are often caused by excessive commutator temperatures due to one or more of the causes enumerated above, or the trouble may be due to structural defects. In any case the remedy is to true up the commutator in a lathe.

High mica segments are sometimes the cause of sparking for the same reasons as given above, and are caused by the same conditions, or an unequal wearing away of the copper and mica. The remedy is as before—true up the commutator. An additional precaution against a repetition of this trouble consists in cutting down the mica segments about 1/32 of an inch below the surface of the commutator with a small three-cornered file. Care must be taken to remove any small particles of copper which may bridge across contiguous bars.

Excessive lubrication of a commutator or neglect in cleaning it may cause sparking on account of the gummy high resistance coating which forms on the surface. Only a very slight amount of lubrication is actually required, and a small piece of clean cloth, free from lint, dipped in machine oil and squeezed as dry as possible between the fingers answers the purpose admirably.

An open circuit in the armature winding is characterzied by the viciousness of the resulting sparking when the commutator bar to which the coil is connected passes under each set of brushes. A temporary remedy in a case of this kind is to bridge the blackened bar to one on either side of it, but the primary cause of the trouble should be located and repaired at the earliest possible moment.

If only one set of brushes sparks with a correct spacing of the several sets, the trouble is probably caused by an unequal distribution of the field flux due to a partially short-circuited field coil, or unequal field pole flux distribution on account of the armature not being central in the bore of the field.

Insufficient brush tension and the consequent chattering with the slight irregularities of the commutator surface is often the cause of sparking. The greater the current the more vicious the sparking will be, and the greater the cutting and wasting away of the commutator bars. In order to obtain equal contact resistance and an equal division of current among the brushes of any set, the tension of all the brushes should be the same. A pressure of 2½ lbs. for carbon brushes, and a maximum pressure of 6 lbs. for graphite brushes is recommended. The "feel" of the brush tension should never be depended on, but each brush should be accurately adjusted by means of a small spring scale.

With high speed exciters a commutator slightly out of round may cause the brushes to throw away from the commutator and produce sparking. The cause of a commutator getting out of round may be excessive heating, unequal brush wear, or a structural defect. In any case the remedy is obviously to true up the commutator.

Voltage Variations.—Exciter voltage variations are a serious trouble on account of their direct action upon the alternator voltage. These variations may be caused by dirty or loose contacts in the exciter itself, in the rheostats or alternator field, or in the exciter wiring to the switchboard and machine. Where the above trouble is being experienced, it will be well to examine each binding screw, clamp and connection very closely by disconnecting, cleaning, and again tightening up the connection. The fact that a screw is tight is no proof that the contact is good.

A dirty commutator may cause a variation of the exciter voltage on account of the variable brush contact resistance.

Speed variations of the exciter due to changes in the alternator speed, and in the speed of the driver in the case of separately driven exciters, or exciter-belt slippage, may cause voltage variations in the exciter with a corresponding effect upon the alternator. Sparking of the exciter from any cause may have the same effect.

Failure to Operate.—The failure of an exciter to operate after having been in service and no changes in connections made, may be due to a reversed or "killed" magnetic field caused by opening the exciter switch before turning in the resistance of the rheostats. Where the switchboard is not equipped with a field discharge switch, this precaution is doubly good on account of the prevention of the inductive "kick" accompanying the break-

ing of the field current, which may puncture the insulation of the alternator field winding and cause a short-circuit.

An open circuit in the shunt field windings or connections, wiring or rheostat may be the cause of the trouble, and can be located by a thorough and systematic testing out with a magneto. A dirty commutator from the excessive use of commutator compound or other lubricant may also be the cause of this difficulty.

Drawing Conductors Into Conduit.

BY T. W. POPPE.

Something which requires skill, though apparently simple, is the insertion of conductors after the conduit work is complete. A knowledge of the manner in which the conduit has been installed is required. In most buildings the conduit is run as planned by the electrical engineer in charge of the work. Should any changes be made in the installation otherwise than shown on the plans, a diagram of the change should be placed on file for reference, otherwise time will be lost tracing the conduit when ready to draw in the conductors.

In all cases when drawing in the conductors a snake (a steel spring as long as required and about ⅛-in. wide and 1/16-in. thick) is pushed into the conduit, starting at one outlet box and continuing until the end of the snake enters the next outlet box on that circuit. The snake being more or less flexible will find its way around all the bends.

Should the "snake" refuse to continue to enter the conduit after starting it should be withdrawn and a small open hook made on the forward end. A piece of cotton-waste should be soaked in kerosene oil and placed near the mouth of the conduit being snaked, so the snake will thus become well oiled and will immediately enter the tube and need not be rehandled.

Should the snake then refuse to enter the full length of the conduit, another snake with a small hook bent upon one end should be fed, hook formost, into the opposite end of the conduit. While this is being fed into the "opposite" end the person at

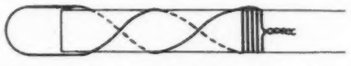


FIG. 1.—END OF SASH CORD WITH WIRE LOOP ATTACHED.

the first end should hold the snake between his teeth, allowing no part of his lips to touch the strip. As soon as one snake touches the other the contact vibrations will be transmitted through the snake to the person at the first end of the tube, who will clearly feel them through his teeth. When this happens the balance of the snake at the opposite end should be coiled up and turned in a manner so as to tend to twist the snake entering the conduit. This should be done until the snake has been "twisted" or turned over in the conduit several times. Doing this tends to cause the snake from the opposite end to twist around the one from the first end. When this has been done the snake should be withdrawn from the opposite end and the one from the first end pushed or fed into the conduit in unison. This will aid the snake being pushed into the conduit to pass the obstruction, which is generally a bend. This often happens where five or six elbows are in one line of conduit or where a less number of bends are close together.

A sash cord, about ⅜-in. in diameter, is attached to the hook on the snake and drawn into the conduit. Care should be taken when attaching the cord to the snake to avoid any bulky knots. Fig. 1 shows the end of a sash cord with a wire loop

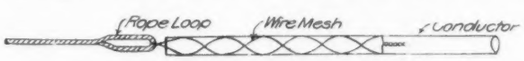


FIG. 2.—WIRE MESH AND DRAWING-IN ROPE.

attached. The wire is fastened to the cord by making holes in the cord with a brad awl and pushing the ends of the wire through the holes thus made. The ends of the wire are then wrapped around the cord and covered with tape.

The cord being drawn through the conduit, the conductors are attached to the cord after the snake has been detached. On small conductors 6 in. of the insulation is removed and the bare wire passed half way through the loop on the cord and the end bent over and wound around the part of the bare wire which was not passed through the loop, in order to keep the diameter of the conductors uniform while being drawn into the tube. Too great a bulk would cause too much resistance to the passage of the conductors through the tube, and would necessitate too strong a pull on the wire or conductors. Before "pulling" the wire into the conduit it should be well covered with soapstone powder and some of the powder blown into the conduit to aid the passage of the wire through the conduit.

Where the conductors are in the form of coils use should be made of a reel on which the wire is placed and from which it

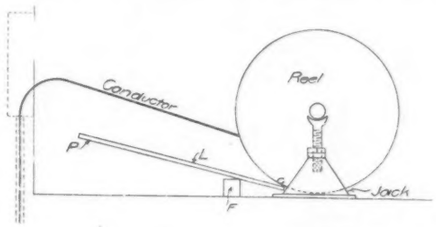


FIG. 3.—FEEDING CONDUCTOR TO CONDUIT FROM REEL.

uncoils while being drawn into the tube in order to prevent the conductors from twisting and kinking and aids the workman greatly as he does not have to stop to unroll the coil. When the wire becomes twisted it often breaks inside the insulation leaving the insulation perfect and the conductor apparently continuous. It is often drawn into the conduit in that condition and causes trouble later.

The above applies to conduits and conductors of small size. In the larger sizes where the removal of the insulation would cause too great a loss of material, a wire mesh can be made around the conductors which are grouped together, by using two pieces of wire, doubling them and putting them through a loop in drawing-in rope. The two ends of one piece of the wire are then wrapped around the conductors. The two ends of the other piece of wire are also wrapped around the conductors starting from the side opposite the first one. When completed the mesh presents an appearance similar to the diagram in Fig. 2. This mesh never loosens; the greater the strain placed on it the greater the mesh holds. When cables necessitating meshes are drawn into the conduit ropes larger than the one mentioned should be used. A ¾-in. rope has been used to draw conductors into tubes ranging from 1-in. to 2-in.

It is always good practice to have the conductors enter the tube at the highest point, as the weight of the conductors will then aid in the insertion of them. When conductors are to be drawn into upright lines of conduit, the downward pull due to their own weight often necessitates taking some precaution to prevent them gaining too great a momentum and actually "running away."

Fig. 3 shows a reel containing a conductor which is being drawn into a conduit. The reel has been placed on jacks, a bar of iron being run through the center of the reel. One jack is arranged at each end of the bar of iron, and the reel is raised to the desired height. The reel is so arranged that should a sudden pull throw it off the jacks it will tend to roll away from the point where the conductor is being drawn into the tube. It will thus refuse to allow any of the conductor to be drawn from it. The straight fall of the conduit in Fig. 3 would cause practically no resistance to the passage of the wire or conductor, and it has sometimes been found necessary to use a brake to stop the reel from turning too quickly when the conductor was entering the conduit too fast, by using a 2-in. plank as a lever and a small block as a fulcrum. In this manner a small pressure at *P* caused the lever *L* to come into contact with the reel at *C* and the weight of the reel and the conductor it contained caused so much friction that the reel stopped turning very quickly.

Protection of Motors in Dusty Places.

By Kingsley Williams.

It is practically impossible to exclude grit and dust from open type motors running in rooms or shops where emery wheels, buffing or polishing wheels are in constant operation, so that the underwriters have insisted on such motors being enclosed in these places, in order to limit the fire hazard.

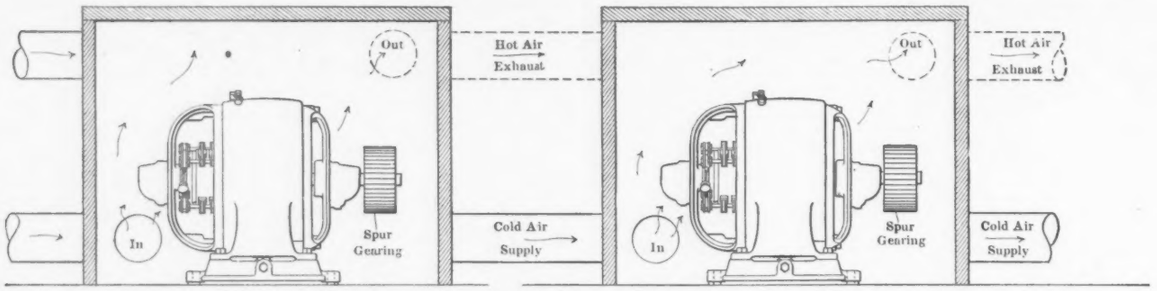


Fig. 1.—Ventilated Housing for Motors Working in Gritty Places.

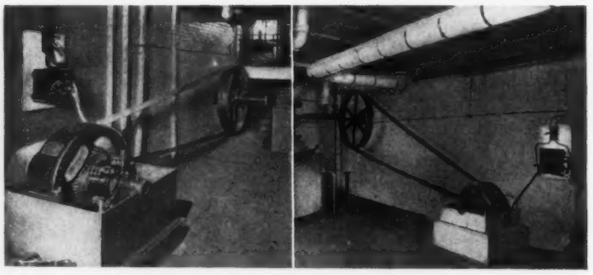
Various methods of enclosing open type motors are in use. One, is to place the motor in a box, with slits in the latter for the passage of the belt. Another, is to place the motor in an air-tight box the power being transmitted by coupling direct from the motor shaft to a counter shaft; while still another method is to enclose the motor as before, a rawhide pinion and gears serving to deliver the power.

The first if these methods is faulty, since the slit in the box destroys its usefulness as a dust excluder. The belt running towards the motor draws with it the dust, which soon settles on the armature and field windings and also on the commutator, with the usual result. Where the armature and field windings are well covered with shellac, they usually escape damage, nevertheless the cause is still present. In the second and third methods, the grit and dirt can be successfully excluded; but an equally injurious condition results, unless some way is provided for ventilating the enclosure, namely, the heating of the motor.

A novel method of ventilating motors thus enclosed is illustrated in Fig. 1. Here the heated air is drawn out of the boxes through pipes as indicated. while cool air enters at the bottom. All the boxes are connected to common feed and exhaust pipe lines, the former connecting with the lower left-hand corner in the rear of the box, while the hot air is taken out at the upper right-hand corner of the front of the box, so that the motor is thoroughly ventilated. One or two fan motors may be used with this arrangement; one to force the air through the feed pipe to the boxes, or one to force and the other to exhaust the air; in the latter case a fan motor is connected with each pipe line. Another method of accomplishing the same result, is to force the cold air in through the bottom of the enclosure and permit the warm air to escape through the top of the box.

A cheaper method of ventilating the motors is shown in Fig. 2. Here the motors are ventilated on a kind of series system. All the boxes are connected as indicated, and one fan forces the air to pass through each box in succession. The method is open to some objection since the air in passing from one box to the next becomes more and more heated, so that if the number of boxes is large, the last motor box in the series receives comparatively hot air. This objection may be overcome by making the series small. It will be noticed from the engraving that the air must of necessity pass through the motor, and it would appear that with this method the ventilation is more positive than by the former methods.

When motors are enclosed in boxes attached or suspended from ceilings, no braces should be used within the box, since these take up room and also prevent the motor from receiving proper attention. Besides, when armatures are to be changed or bearings removed, difficulty is encountered unless the boxes are very large. If the boxes are built snug against the motors, the sides should be made removable, so that the motor may if necessary, be inspected from all sides. Fig. 5 shows a motor box suspended from the ceiling and braced on the outside to resist any strains imposed. The doors or sides which enclose the motor are made to slide, so that when it becomes necessary to change an armature or renew bearings, the bottom and top strips holding the sliding doors in place can be taken off. Where only oiling and inspection are required, the doors can be pushed to one side leaving the motor free for inspection and test.



Figs. 3 and 4.—Motors with upper part of enclosing cases removed.

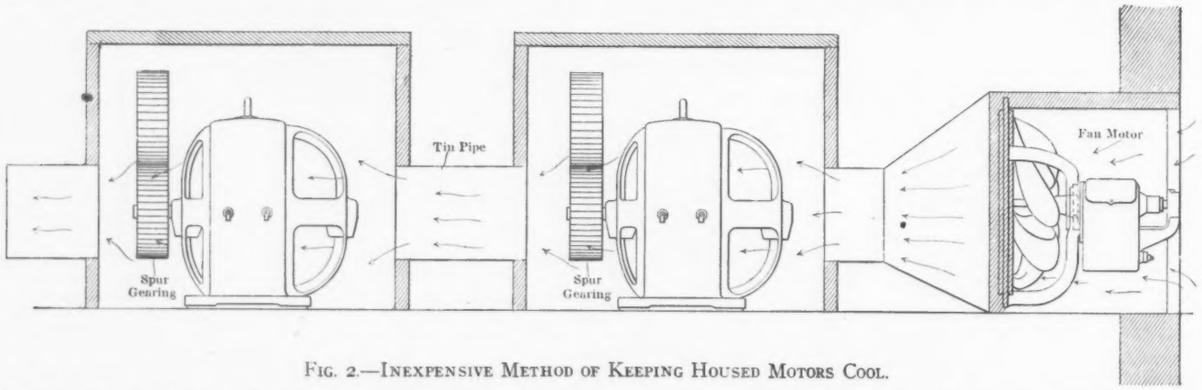
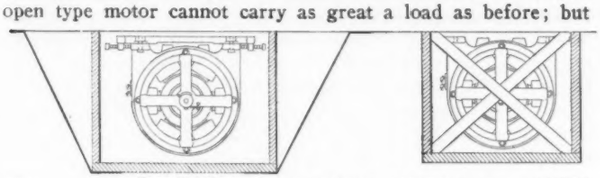


Fig. 2.—Inexpensive Method of Keeping Housed Motors Cool.

A faulty method of housing a motor suspended from the ceiling is shown in Fig. 6. In this engraving it will be noticed that the bracing is so situated as to render it impossible properly to inspect the bearings. A motor box thus braced also makes it impossible to remove an armature or insert a new bearing without first removing the braces.

It is of course possible to use enclosed motors in places exposed to grit and dust; but horse-power for horse-power, the open type motor is cheaper. To be sure when enclosed in a box, an open type motor cannot carry as great a load as before; but



FIGS. 5 AND 6.—PROPER AND IMPROPER METHODS OF BRACING MOTOR BOX.

when ventilated as indicated in these sketches, it will carry the same load as before. Moreover, if encased as shown in Fig. 2 with a blast sufficiently strong the capacity of the motor can be increased so that with a 5-hp outfit, 7-hp and even 10-hp can be taken continuously without overloading the motor, since by robbing the motor of its heat, the overload limit is also further removed.

Brush Holders and Brushes for 500-Volt Motors—II.

By Eugene C. Parham.

Having considered in a previous article the more important ultimate requirements of a brush holder, it is in order in the present article to see how local departures from these requirements will affect results. On motors of the stationary type the armature coils are usually multiple connected; *i. e.*, the armature has several paths in multiple and diametrically opposite brush holders are connected on a four-pole machine. On such armatures, for magnetic reasons, it is not advisable for the air-gap to be larger in one place than in another. As the air-gap on such machines is rather small anyhow, the bearings must be renewed before wear in them allows the armature to drop sufficiently to appreciably affect the sparkless operation of the brushes. Railway motor armatures are generally series connected; this means that for every conductor that may be in a weak field due to a large air-gap there is in series with it another conductor in a strong field due to a small air-gap. The running of such machines is not affected by an ununiform air-gap. In Fig. 1, the full lines show the relative positions of the commutator and brushes when the bearings are new, and the dotted lines the positions after the bearings have worn as much

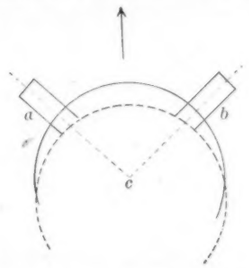


FIG. 1.—POSITION OF BRUSHES WITH NEW AND OLD BEARINGS.

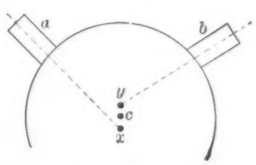
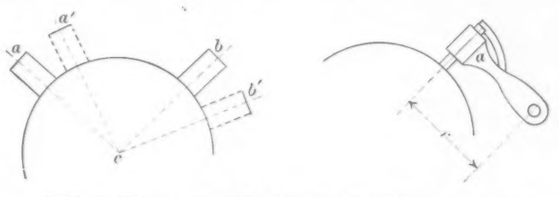


FIG. 2.—DEFECTIVE POSITION OF BRUSH HOLDER.

as permissible without the core striking the poles. The dotted positions show that the effect of wear in the bearings is to lower the armature bodily, which is the same as if the brush holders were raised bodily, thereby causing the brushes, when they feed through in accordance with the lowering of the armature, to not only come nearer together on the commutator, but to wear to a beveled surface. Now, the coming together will cause sparking directly and the beveled surface will cause it indirectly, because the beveled surface is wider than the normal surface and can, therefore, short-circuit coils that may be in a comparatively active field.

As said before, on a stationary motor where the permissible wear in the bearings is small, this effect can be neglected; on a motor of the railway type, however, where the air-gap is much larger and, in addition, the armature bearings may be babbitted eccentrically above the center to increase the useful life of the bearings, the movement from new bearings to old bearings is considerable and the change in the set of the brushes may amount to as much as 1¼ bars. The effect of vertical displacement of the armature is to bring the apex of the angle formed by the brush axes above the center of the commutator. It can be seen, then, that any irregularity that effectively raises or lowers the holders as a whole from their normal position, will change the set of the brushes. As a fact, in emergencies, when a railway motor brush holder brings the brushes too close together, it is the practice to put a fiber or metal liner between the holder and motor frame at the point of support; this forces the holder bodily downward, which is the same as forcing the commutator bodily upward, and spaces the brushes apart an amount depending on the thickness of the liner. In view of the effect of this bearing wear it would seem wise for the manufacturing companies to ship their motors with the brushes adjusted to give a spacing somewhat too great.

The point of support of all brush holders is a considerable distance from the point of contact between the brush and the commutator; bearing in mind the requirement that the apex of the angle formed by the axes must coincide with the center of the commutator, it is seen that but little deflection from the true direction at the point of support can produce con-



FIGS. 3 AND 4.—BRUSH HOLDERS IN WRONG POSITION.

siderable error in the set of the brushes. Thus in Fig. 2 the error in the holder is such that its *a* axis points below the center of the commutator; with two holders so affected, the result would be to have the brushes get further apart as the commutator wore. On the other hand, with the holder so affected as to direct its axis above the center of the commutator, as in the case of the *b* holder, Fig. 2, the result of the commutator wear would be to bring the brushes closer together. In either of the preceding cases the effect will be to have both brushes spark. If the axis of one holder points correctly while that of the other points incorrectly, the brush with the axis in error will spark.

Fig. 3 exaggerates the condition where error in the holder moves both sets of brushes too far one way or the other; a motor with brushes so disposed will run sparklessly in one direction, but will spark when run in the opposite direction. Such irregularity can be obtained on a stationary motor as the result of dimension, *r* Fig. 4, being too great or too small on all holders. If some of the holders are right and others wrong in this respect, the result will be the conditions illustrated in Fig. 2. The possibility of such a condition finds practical application in the practice of setting back against the direction of rotation the brushes of motors that are to operate in but one direction; of course, on attempting to operate in the opposite direction a motor with its brushes so set, there would be sparking; but this possibility can be offset by arranging to prevent the rheostat or starting box from being advanced beyond a predetermined position whenever the motor is to be operated in the reverse direction for temporary causes.

On most modern motors, both of the stationary and railway types, the brushes are provided with flexible copper shunts that connect the brush directly to the brush holder. In many places,

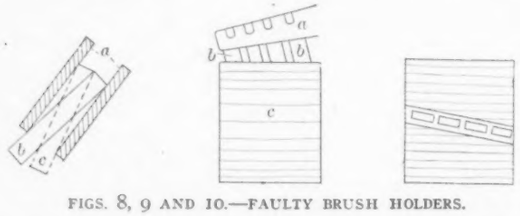
one finds these shunts discarded; there is never any good reason for so doing, the usual excuses being either that "We ain't got no more of 'em" or "They ain't no good anyhow." The writer is not prepared to present his case with as much force as the preceding, but he has no doubt that the shunts do good especially on motors operated on a railway circuit where every short-circuit on the line outside subjects the shop motors to a

FIGS. 5, 6 AND 7.—APPLICATIONS OF TENSION TO BRUSHES.

temporary, but severe overload. The shunts save the hinges and springs, and make the conductivity of the holder independent of the surface contact between the brush holder and brushes. The writer recalls three instances of open-circuit in a motor being due simply to oxydized condition of the inside surface of the brush holder. Short-circuits had produced little raised pimples that were harder than a file and that would not pass current at all. The cases of the temper of holder springs being drawn by the heat of current passing through them are innumerable. The shunt looks good and should be kept.

A good wrinkle to be used in conjunction with a shunt is illustrated in Fig. 5; here the brush part where the tension finger bears is beveled so that a certain component of the tension is directed to forcing the brush against one side of the holder. The tension used on motors that operate cars varies from 6 lbs. to 10 lbs. per square inch; the writer sees no reason for such wide variation other than a difference of opinion as to what it should be. Half the lower value is sufficient for stationary motors, provided they are not subjected to vibration. Vibration is one of the easiest things to stop and is one of the commonest abuses to which motors are subjected. Whatever the tension adopted, it should be allowed to exercise full force. To this end the inside of the holder should be kept clean, the tension finger should bear as in Fig. 6 and not as in Fig. 7, the holder should be firmly secured, the hinges should be given a drop of oil occasionally, and the movement of the brushes in the holder should be kept free.

A common fault is to operate the holders too far from the commutator. Some play between the holder and brush is necessary to insure free movement of the brush in the holder. In course of time the holder becomes worn and the clearance becomes greater than necessary. Fig. 8 exaggerates the effect of having the holder too far from the commutator under this condition. The greater the clearance between the holder and commutator, the greater the slanting position taken by the brush, the greater will be the error in set introduced and the greater the liability of the brush to break. On motors that



FIGS. 8, 9 AND 10.—FAULTY BRUSH HOLDERS.

must operate in both directions, the brush wears to two surfaces, neither of which has the carrying capacity of the cross section of the brush. On the other hand, it is not well to operate the holder almost down on the commutator because a sort of mud, due to paraffin, commutator compound, where such is used, oil and carbon dust collects and packs into the small clearance and eventually causes trouble. About the right distance is from ⅛ to ¼ inch. The distance of the holder from the commutator also affects the tension of the brush holder spring. When the holder is well down the force exerted by the spring is more directly in the direction desired than when the holder is well up. With the force more direct less tension is required.

All brushes and holder ways should be gauged to avoid as far as possible the chances of having a brush stick in the holder. In course of time the holder ways wear and permit too much clearance; the way should then be either machined and relined or should be scrapped. Brushes from the factory are supposed to be of uniform thickness, but they are not; different batches of brushes will be of different thickness and width and different brushes in the same batch will vary in thickness and width. Some brushes will be thicker or wider on one end than on the other, with the result that they will enter the brush-way freely if presented small end first, but will wedge and cause trouble when they wear down a certain distance. The only way to avoid trouble due to wedging, assuming that no gauge is available, is to try both ends of the brush in the holder before putting it in permanently. Where a brush is too thick, it is a quite common practice to sandpaper it thinner. Sometimes this remedy is unavoidable, but it should be avoided if practicable because it removes the copper plating and increases the tendency of the brush and holder to heat. Inspection will often show that failure of the brush to enter freely is due to a finn or burr in the holder itself or to the holder having been distorted by a fall or blow. Some brushes gum more readily than others owing to an excess of paraffin in them.

Figs. 9 and 10 exaggerate two faults likely to obtain to the greatest degree on long holders for three or more brushes side by side. In Fig. 9 the holder is not parallel to the commutator; the result is that some brushes get more tension than others, the brushes do not wear evenly and there is the possibility of some jamming eventually taking place. In Fig. 10 the holder sets across the commutator, thereby effectively increasing the width of the brushes as a whole. This means that the brushes short-circuit more coils than they should and with consequent heating and sparking. Any motor will operate best with a certain brush thickness that has been determined, perhaps, experimentally, and any irregularity that increases or decreases the thickness should be avoided.

Current passing through the holder springs draws their temper, makes them weak and leaves the brushes with insufficient tension. If sparking of a brush is due to weak tension, the sparking will cease when the brush is pressed down with a stick—this is the test for poor tension. In many places excessive tension is used as a cure for sparking due to some other cause; all tension over and above what is needed simply increases the wear on the commutator and brushes and is to be avoided. Sparking troubles sometimes attributed to poor adjustment of the holder, may be due to rough commutator or eccentric commutator or to a high or low or loose bar in the commutator or to a loose core or commutator having twisted around until the bars short-circuited by the brushes are no longer connected to coils that are in a commutating part of the field. The brush holders have so many faults to which they are entitled by abuse and neglect that it is unnecessary to further burden their responsibilities from other sources.

The Loss in Leaky Boiler Settings.

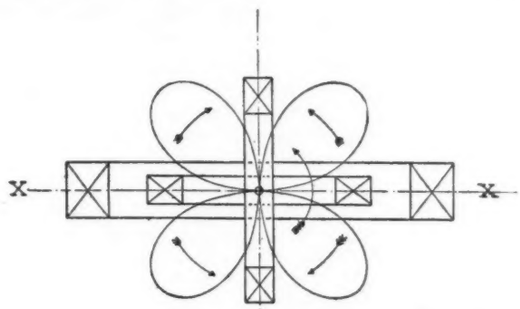
A notable case of saving in fuel by stopping the air leaks in boiler settings has been made in the Stratford Hotel, Chicago, the mechanical plant of which, together with that of the Railway Exchange Building, Chicago, is in charge of Mr. F. J. Saxe. The boiler setting in this case was covered with a layer of asbestos cement over which canvas was pasted and the whole covered with a coat of heavy paint. The saving as a result of this change is stated to be about $100 a month, or 12½ per cent of the monthly coal bill. The boiler is run 24 hours per day in lighting service. Mr. Saxe says that simply coating the brickwork thoroughly with red paint so as to fill the pores will cause a marked saving of fuel in almost any boiler.

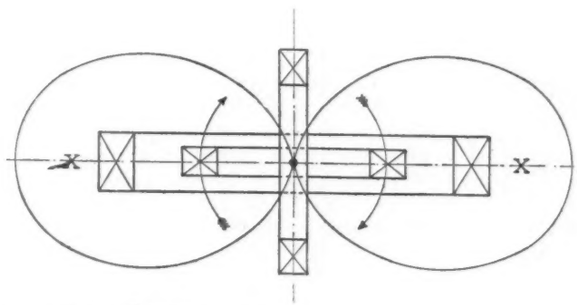
The Synchroscope.

BY D. H. COHEN.

This interesting instrument, the invention of Mr. P. M. Lincoln, was first applied in practice at the power house of the Niagara Falls Power Company about 1900, and is now an article of commercial manufacture. Its functions are so well known that they need not be commented on here. However, a description of its construction, and more particularly its operation, may prove of interest.

Its main features are a stationary laminated iron field provided with a single-phase winding, and a laminated iron armature, capable of rotating, and supplied with two or three coils so spaced as to be able to create a revolving flux. To the armature is attached a pointer which moves over the dial. The bus or running machine is connected to the field winding through the lower binding posts, and the starting machine to the armature through the upper binding posts and slip rings.





FIGS. 1 AND 2.—REVOLVING FLUXES IN THE SYNCHROSCOPE.

The armature is sometimes supplied with polyphase currents from the incoming machine, but the most common method is to supply single-phase current, obtaining two phase in the armature by means of an incandescent lamp in series with one coil, and a reactance in series with the other coil.

Referring to the diagram, Fig. 1, let it be assumed that the armature flux is rotating as shown by the arrow, and that the south pole is just crossing the axis, *X X*, on the right when the current in the field coil is zero, and about to flow so as to create a north pole above. Let it be assumed also that the two sources of e. m. f. are of the same frequency, and of sine wave form. It will be seen as the phases progress that, owing to the laws of magnetic attraction and repulsion, and considering the inertia of the armature, there will be four impulses in alternate directions per revolution of the armature flux, which corresponds to one cycle of e. m. f.

The successive directions of the impulses on the armature in the four quadrants are shown by the arrows, while the curves showing the instantaneous values of the forces have been calculated for an assumed ratio of fluxes, and plotted in polar co-ordinates.

It is obvious that the integrated forces per revolution of flux will be zero, so that no revolution of the armature will be produced, the only effect being a vibration.

Let the armature be assumed to be mechanically rotated 90° in the direction of the revolving flux, as shown in Fig. 2. There will now be only two impulses per revolution of the flux, and these will be much stronger than before, and in the same direction, thus tending to restore the armature to its former position. Between these two extreme positions there will be an irregular four-lobed diagram of forces in alternate directions, but two of them predominating so as still to tend to return the armature to its first position.

If one assumes the armature mechanically rotated 90° in the opposite direction, the forces would still tend to return the armature to its former position. If the armature polarity of Fig. 1 be reversed it will remain in the same position; however, it will be in unstable equilibrium, for if one assumes it displaced it will revert to the conditions shown in Fig. 1, which is the neutral position, on the assumptions made.

The mechanical displacements assumed are equivalent to the displacements of phase caused by unequal frequencies, though of course very slight displacement from the neutral position would be required to produce rotation of the armature if its friction were negligible.

It is thus evident that under all conditions the armature will so place itself that its flux will coincide with that of the field south to north pole at the instant when the latter is at its maximum value. Hence if the frequencies of armature and field differ, there will be one revolution of the armature per second for each cycle of difference in frequency; the direction of rotation depending on which is the greater.

When the revolutions become quite slow, about one in five seconds, the machine may be "thrown in," when the pointer indicates coincidence of phase.

It may be noted here that lamps are usually used in connection with the synchroscope, both as a reserve in case of trouble with the instrument, and because the synchroscope will not "fall into step" on account of its inertia, until the two frequencies approach within about 10 per cent difference.

A synchroscope has also been constructed on the "inductor" principle with no moving wire, but the method of operation is exactly the same as in the Lincoln type.

Suggestions for the Power House Operator.

BY ARTHUR B. WEEKS.

Originality in large power plant operation from the electric end is greatly to be desired. Instead of working mechanically, the operator should learn to think for himself and figure out new ways, shorter and more accurate ways of switching, paralleling, emergency work, etc. When a plant has been long in operation, the men in charge are accustomed to work in a certain way and get into a rut, believing that no other method than their own is practicable. A new man may at once see new and better ways. We are creatures of habit; and often after changes in equipment to another lot of machinery requiring different handling, wrong switches are thrown on the spur of the moment, and things may end disastrously.

At a certain power house, a new electrician was starting up after a short on transmission lines, 20,000 volts on the line. As the transformers, switches, etc., with the exception of the dynamo and feeder switches, were in a remote building, his assistant was given instructions as to which switches to throw. He was following instructions accurately, when an assistant superintendent, noticing what had been done, pulled the line high tension switches out again. A higher official questioned his judgment in the matter, and the assistant electrician was closely questioned as to his orders. Other investigations were made through the chief operator; and the cause of all the commotion was that the operator had a few original ideas, and had put them into practice. The others, seeing it was not as they had formerly done things, proceeded to undo them. The result was an order issued to the men that no one should interfere with instructions given the assistant electricians, and that under no

circumstances should the authority of the operator be questioned.

However iron-clad the rules, there comes a time when a man must act on his own initiative. There have been cases where men have broken rules and saved life and property by so doing. It is the policy of some men to follow rules regardless of consequences. This may be to the satisfaction of some companies, but with others would not be approved. Where good service is required, intelligent men can be depended on in emergencies, if not called to account for having done the obviously right thing. Rules are necessary, to be sure, but reason should also be used. Nothing is more discouraging to a man than to feel that one has lost confidence in him.

Under trying circumstances, the man who remains in possession of his faculties is master of the situation. When generators are ablaze and revolving at full speed, or when the power house is filled with smoke from some as yet undiscovered source, or terrifying noises are heard, any man who can hold his own is a hero. Seldom do the "bad" stunts of the insides of power houses reach the outside world; but some men who have lived through the terrors of power house operation among high voltages would rather face a line of cannon on the battlefield than renew their experiences. However, thanks to improvement of apparatus, these risks are becoming gradually less and less.

Sometimes the spark from a small fuse will start a short circuit and burn up material valued at thousands and thousands of dollars. Get after details; know every wire and switch and the use of each. Never be guilty of guessing or taking a chance; know what you are to do, and why. During the day, when you have been at home asleep, some changes have undoubtedly been made; perhaps you should have been told, but someone has forgotten. You are responsible, just the same; it is your business to find out. That is the rule. Perhaps you would suggest that some one in the office be instructed to give you a typewritten notice of any and all changes; this is, of course, as it should be, but things are not always as they should be.

In case of accident: did you do your duty? Did you understand the situation, or did you guess at it, and thus mix things up? Did you make a mistake? Answer truthfully when you are called on for a report; nothing is lost by so doing. Take your medicine like a man, but profit by the experience. The employer who uses reason will likewise use good judgment, and things will thereafter improve. To call a man down unmercifully will break his spirit and unfit him for duty. A "don't care" mood may result soon in another smash-up. In small plants, these things do not count for so much; but where thousands of horse-power are involved it is a serious problem. Where there has been carelessness displayed in the handling of apparatus, it is right that the operator should be made to know it; but where it cannot be proven that he was at fault, give him the benefit of the doubt.

Do not make frequent changes in the heads of operating departments. Understand all conditions yourself, and talk over matters with the men, and you will be the gainer. The superintendent who bullies his men will make a failure of his position and cause good men to leave, or make them unruly and dissatisfied. This is not conductive to good operation. Men like a superintendent or manager who knows at least as much as they do of the plant, and the more the better. Small-minded men are afraid to impart knowledge to others. Sometimes jealousy will prompt evil-minded men to take base advantage over others by deliberate planning.

Have your men trained to know what to do when accidents or emergencies arise. Insist on their giving strict attention to every detail of their positions. As your success depends largely on their performance of their duty, maintain strict discipline always, allowing no familiarity, though pleasant and agreeable. Know yourself, and give no foolish orders; be calm, keep cool; and be in your place to see that others do likewise. When you learn any new points, pass them on to your men, and you will be the gainer.

Central Station Ailments.

A brief composite sketch of the more common ailments from which many central station companies are suffering may not be without interest. Without attempting any generalities, the conditions in a single plant which is suffering from a number of the more common ailments will be described.

To begin with, the company is owned by local capitalists who know nothing about the electric light business and although the owners are good business men in their respective lines, none of them has ever given the electric lighting business close attention, which is very unfortunate for the property, because if good business common-sense had been applied to its management, it would not have been the indifferent success that it now is. The company has had various superintendents who were supposedly competent practical electrical men, but since so little attention was paid to the business by the owners, it has frequently happened in the history of the plant that incompetent or dishonest superintendents have been secured with the result that many expensive mistakes have been made, both in construction and operation. The directors have never been willing to pay enough to secure a good superintendent or manager.

The station has a high peak load, but nothing has ever been done in an active way to build up business which comes at any other time than on the peak. The owners have never become awake to the fact that each kilowatt installed represents a certain investment, and that the amount of money that kilowatt of capacity can earn in a year will be dependent largely on the amount it can earn at times other than during the lighting peak each evening. The peak earnings take care of themselves. Although the town has numerous steam and gasoline engines in operation, which are a nuisance to their owners, no attempt has been made to build up a day motor load. The schedule of rates gives the same price per kilowatt-hour to all users without regard to the number of hours' use per day, with the result that the most desirable class of customers which use motors and lamps the longest hours put in electric plants of their own and the private gasoline lighting plant is making great inroads in the commercial business. The result of this system of rates is to leave the company with the most undesirable class of business in the town, viz., that which comes on only at the peak.

No attention is paid to making electric lighting artistic and attractive or to giving the customers the best effects possible for their money. The result is that electricity suffers very much in comparison with others illuminants more skillfully installed. Show-window lighting, sign-lighting and extra display lighting on the down-town streets are unheard of because no one can afford them at the prevaling rates and the directors fail to see, since the company is making no money, how it could make money if its rate schedule was readjusted to make this long-hour lighting within the reach of its customers. They sit back with resignation and say all those things are very well for a large city, but people in our smaller towns are poor; they cannot afford them.

The company does not give free lamp renewals and makes no effort to control the kind of lamps put on the circuit. In fact, it does not even know whether its customers are buying most of their lamps from outside dealers or not. Of course, it thinks it cannot afford free lamp renewals; they mean too much trouble and expense, although the circuits are full of miserably poor, inefficient lamps, and customers are complaining that the company is not giving them good regulation. Although the rates are nominally the same to all customers, there are a favored few to whom for one reason or another, various managements have seen fit to make special rates; the reasons for these special rates being based on nothing but the ability of the customer to drive a good bargain. This, of course, does not make the other customers very happy or tend to promote the use of electricity in the community.

The station is a junk-heap in which the mistakes of previ-

ous years have been perpetuated and added to and no attempt has been made to work toward simplification and apparatus conforming to modern standards. The result is that if a change is ever made it will be an expensive one. The present manager is a business man with little technical knowledge. This is not by any means a fatal defect in a manager, for many good men have come into the industry through the financial and accounting departments, whose business instincts have kept them on the right track. Such successful managers, however, have invariably realized the wisdom of securing good advice and competent employees in the technical side of the business. Their business sagacity has been displayed by their ability to secure and retain good men under them to take care of this part of the business. It is the manager who, while knowing nothing of technical matters, is short-sighted enough not to realize his ignorance and its possible results, that is in a hopeless condition.

Because the plant has never paid any dividends, it has always been discredited financially in the town and has had to struggle along with insufficient capital to properly take care of the business offered, extensions being paid for entirely out of earnings. For this reason the extensions have always been made grudgingly and the plant seems to have always been a lap or two behind the demands made upon it instead of being kept up in a shape to give the good quality of service which is in itself the best advertisement a business can have. The voltage regulation is atrocious, varying 10 per cent. above or below normal, owing to the carelessness of the operating men at the station, this carelssness being due in turn to laxity higher up in the manager's office.

It almost goes without saying that the company's offices are in dingy, dusty quarters on a side-street. Their illumination and general appearance is anything but what the public should rightly expect from a company which is interested in promoting the use of electricity. No one around the place knows anything about the recent developments in the business or is familiar with the ideas of the leaders in the industry, as a technical paper is rarely seen about the place. The management depends for its knowledge of what is going on elsewhere in the central station field on an occasional visit to some neighboring town which has an equally unprofitable plant, and on the salesmen of electrical goods who visit the town and get out again as quickly as possible. To be sure, some of them might give the manager considerable information of general value on his business, but that is not what they are paid for, and as he looks upon them all with suspicion lest they sell him something he does not want, his chances of getting out of the rut are indeed small.

The Application of Oil Burners to Steam Boilers.

By William Kavanagh.

From time to time numerous articles have appeared relative to oil burners, but few of these were sufficiently exhaustive to give a precise understanding of the most economical burner or the means by which oil burners could be improved. Such articles merely showed the wastefulness of the oil burners; but little attempt was made to show how such wastefulness could be avoided or lessened. It is obvious that some oil burners are more economical than others and for this reason the following facts pertaining to oil burners, their structure and application to steam boilers will doubtless be of interest.

In the matter of steam generation, the great competitors of coal will undoubtedly be the crude and refuse oils. Crude oil contains more heat units than the refuse oil when equal quantities are considered; but crude oil cannot be bought in the open market so cheaply as refuse, or fuel oil, because the fuel oil in most cases is a by-product of the oil refineries and, therefore, can be sold for much less than crude oil from which numerous products are manufactured.

When oil first became prominent as a means for steam generation there was very little data from which an oil burner could be built to use oil economically, and therefore become a close competitor of coal in cities and towns remote from the oil regions. It is only in the vicinity of the oil wells, where oil can be obtained at first cost, that such a burner as shown in Fig. 1 can be used owing to its extreme wastefulness. This oil burner is usually home-made, requiring only a cross and four nipples for its construction as shown. The steam enters at *A* and by blowing steam across the outlets, oil and air combining

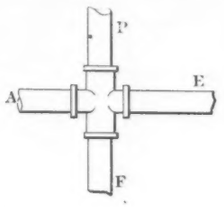


FIG. 1.—WASTEFUL BURNER.

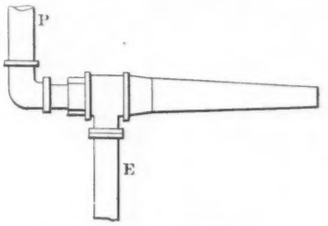


FIG. 2.—BURNER REQUIRING INDEPENDENT AIR DUCTS.

with the steam are ejected at *E;* the oil being fed to the cross by means of pipe *P,* while the air enters at *F.* The connection of this burner to a steam boiler furnace involves the erection of a mass of fire-brick within the furnace, against which the flame is discharged, the object being to break up and scatter the flame. The burner under consideration is not capable of the initial generation of steam, as air or steam pressure must be supplied for its operation from some independent source, but after steam is formed in the boiler the burner can be operated by means of this steam. In general where such burners are used, the boilers either run night and day or a separate steam boiler is used to supply the initial pressure, coal or oil being used in the furnace of the separate boiler.

Fig. 2 shows a burner in which the steam employed for its operation is surrounded by oil; the object being to increase the temperature of the oil in order to compel it to approach the gaseous state. Steam enters through the pipe *P,* and oil is drawn in through pipe *E.* A union of the oil and steam occurs near the end of the tapered nozzle; the mixture being ejected into the furnace under the same conditions as in Fig. 1, with the exception, that independent air ducts must be formed for the combustion of the oil, as this burner is not fitted with an air pipe.

Fig. 3 shows the steam nozzle which is inserted in the body of Fig. 2. The steam flowing through the tapered opening is accelerated, thus yielding a powerful flame, which, if allowed to act for some time on a fixed point of the shell or tubes of a boiler, would rapidly destroy the iron, even though the shell or tubes contained water. For this reason the flame is compelled to act on or through a series of brick arches which break up and scatter the flame, thereby preventing a continued

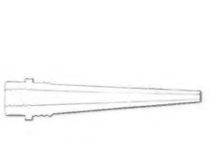


FIG. 3.—STEAM NOZZLE.

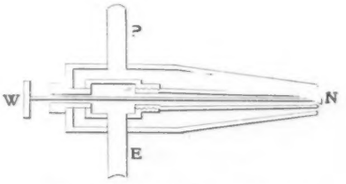


FIG. 4.—ATOMIZER BURNER.

application of the flame on any fixed point. This burner is capable of generating steam without the aid of an auxiliary boiler; but the amount of oil wasted and the enormous quantity of smoke formed prevent its use as an initial generator of steam.

Fig. 4 shows a burner of the "atomizing" type, the oil pipe is surrounded by steam and the intensity of the flame is controlled by means of the adjustable nozzle shown at *N.* Steam is fed through pipe *P,* and oil enters through pipe *E;* the oil and steam combining at *N.* The burner is similar to that shown in

Fig. 2 with the exception that the flame is controlled at *N* by means of the rod and wheel *W*.

Fig. 5 shows a burner supplied with superheated steam in two places at *A* and *B*. The steam entering at *A* induces a current of air through the opening at *C*. The oil enters the pipe *P* and the steam for atomizing the oil enters at *B;* the air, steam and oil uniting near the point of ejection and forming a powerful flame which must be broken up by means of fire-brick or other refractory materials as shown in Fig. 6.

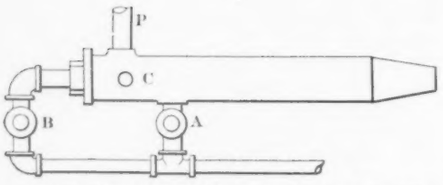


FIG. 5.—BURNER USING SUPERHEATED STEAM.

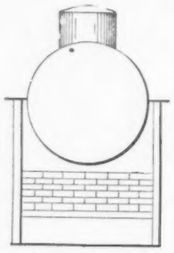


FIG. 6.—ARRANGEMENT OF FIRE BRICK.

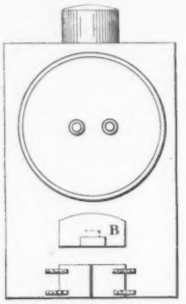


FIG. 8.—AIR CHUTE IN FURNACE DOOR.

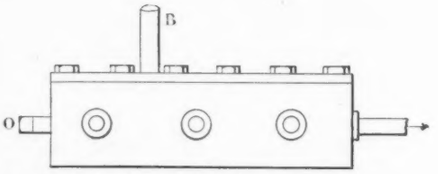


FIG. 9.—SIDE VIEW OF OIL BURNER.

Fig. 7 illustrates one of the first attempts to construct an oil burner that would consume oil in a gaseous state, the burner being itself the gas generator. The burner is rectangular in shape, is made of cast-iron and varies in size. The illustration shows the lid removed and exposes the means by which the oil is ejected. The annular space *S* is supplied with oil through the pipes *P* and *P*¹. Steam is admitted to the compartment *S*¹ and flows through the ejecting nozzles. Three of the nozzles are connected in front and one on each side; the remaining apertures being for the reception of other nozzles.

The oil and steam combine at the point *C* in all of the nozzles as indicated and are discharged into the furnace in the form of a fine spray. The curved arrows indicate how some of the nozzles are employed to heat the burner; the flames being discharged against the sides of the burner, increasing its temperature and converting the oil into a gas. The application of this burner to a furnace requires the grate bars to be made airtight, and the necessary air for combustion is admitted through a small chute on which the burner is placed. Fig. 8 shows the end of a fire-brick or cast-iron chute protruding through a false furnace door, the chute being of sufficient length inside of the furnace door to receive the burner. The latter is shown resting on the chute in dotted lines at *B*. A side view of this burner is shown in Fig. 9; steam being admitted through pipe *B* and oil through pipe *O*.

The disadvantage of burning oil in this way is that the ejecting spaces shown at *C*, Fig. 7, became choked with carbon thus rendering the burner practically useless. The constant deposition of carbon at the points *C* led to the following improvement in burning the oil after it was vaporized. Fig. 10 illustrates the improved burner and the method of connecting it under a steam boiler. The burner is rectangular or circular in shape and is fitted with automatic movable nozzles, as shown at *A*. The steam for ejecting the gas or vapor enters through pipe *B;* the gas being admitted through pipe *C*. Oil from the tank *T* flows into the coil *C*¹ and then into the carbon catcher or eliminator at *D*. The carbon catcher is piped as shown and is fitted with a fine wire screen. The oil inlet pipe extends below the screen; the outlet pipe being connected above as shown. Any carbon deposited in the catcher must pass through the wire screen before reaching the burner. Oil being admitted to the coil *C*¹, flows into the carbon catcher and thence into the burner. The oil, being ignited, the flame will strike the coil thus vaporizing the oil within, which after a few moments will appear as such at the nozzles and the gas will burn as long as the burner is in operation. The surplus oil in the carbon eliminator *D* must be run off after the gas is generated in order to keep *D* as dry as possible. There is a small tap connected to *D* for this purpose.

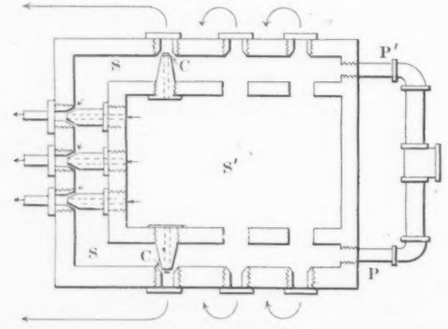


FIG. 7.—DIAGRAM OF OIL BURNER CONNECTIONS.

The piston rod *H* is connected to the piston *P* and extends through the piston located in *E*. Steam is admitted to the cylinder *E*, and the pressure acting on the piston is counterbalanced by means of the spring *S*. The burner in the position shown is supposed to be inside of a false furnace door; the position of the boiler front being indicated by the dotted line *L*. The burner is situated on the air duct *R*, and the air entering the furnace is controlled by the adjustable door *D*¹. A small door is fitted in the air duct at *P*¹, which can be closed at night or whenever the burner is not in operation.

After steam is generated it is admitted to the chamber *P*″ by means of the valve *B*. The heat will then be increased and as soon as the pressure reaches a predetermined point the nozzles at *A* will partly close. Should the pressure fall below a certain point, the spring reacts and opens the nozzles; in this way the intensity of the heat is controlled and also the steam pressure. Should it become necessary to operate the burner by hand, a half nut is arranged on the piston rod near the wheel *H*¹ which engages a thread cut on the rod, and by the aid of this nut the burner can be operated as above stated. This type of oil burner is capable of self-generation of steam and requires very little attention after steam is formed.

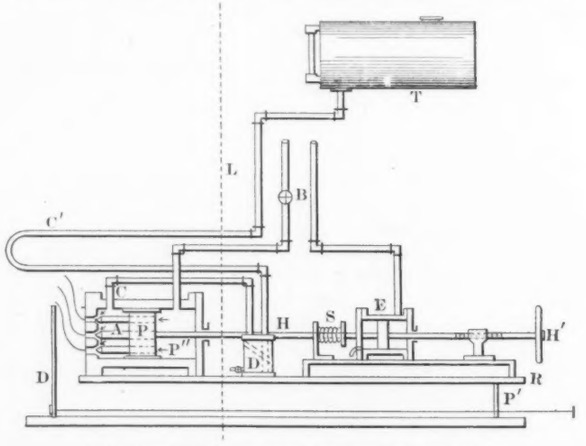
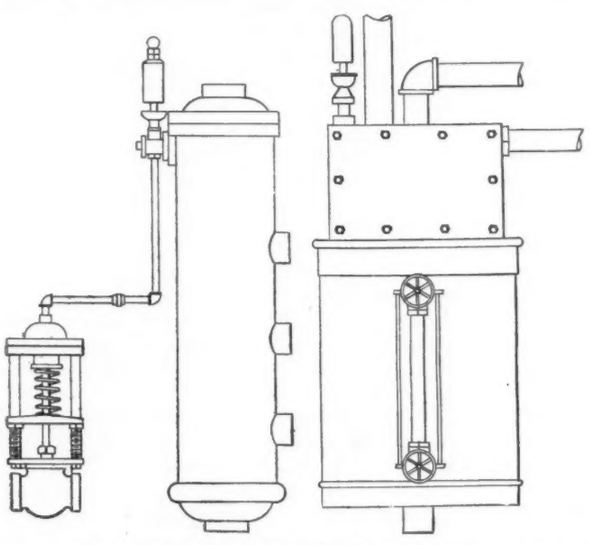


FIG. 10.—IMPROVED OIL BURNER CONNECTIONS.

The Regulation of Boiler Feeders—III.

BY CHARLES S. TOWNE.

With practically every regulator now in the market operated in connection with a pump governor, it is possible to stop the supply of water when pressure in the feed pipe is only slightly above the steam carried, but attempts to make very close adjustments here should be avoided, as they are positively dangerous in many cases. The writer has a good steam gauge on a feed water pipe and observation of it is often interesting and instructive. If for any reason it is desired to raise the water level a few inches, as for illustration when filling boilers to leave at night, and the pump is speeded up for this purpose, it is common to secure 10 pounds pressure in the feed pipe above the boiler pressure. This does not necessarily mean that the feed pipes are choked, as there must be more pressure in them in order to overcome friction, and this increases fast as the speed of the feed water is raised. Suppose that for some reason the water level in one of the boilers should fall low enough to cause the alarm whistle to blow, and the pump should be run fast to remedy the evil. If the regulator is set to close at 5 pounds above boiler pressure, the pump would be stopped at once when it is wanted badly; therefore it ought to be set at a higher pressure to remedy the defect, and wherever



FIGS. 1 AND 2.—COMBINED WATER COLUMN AND BOILER FEED WATER REGULATORS.

a regulator is installed the engineer should know just how much margin is required for safety, and make calculations accordingly.

Nearly thirty years of practical experience with steam and electrical machinery convinces the writer that there is little danger adopting too many precautions to prevent accidents with all parts that are operated under pressure; consequently the high and low water alarms are valuable additions to the plain water column. This conviction is not universal among engineers, as some of them object to these devices very strongly; but what reason can be presented for such a decision? Is not this objection based on the idea that if the water level in one or more boilers does accidentally get too high or too low, the engineer does not want to have other people notified of the fact? Of course, nobody cares to have such things published, but is it not better to have attention called sharply to such a mistake and have a remedy quickly applied, than to let it go until much damage results? One of our very prominent boiler insurance companies object to water columns that are fitted with both high and low-water alarms, but favor the latter alone. They claim that sometimes a fireman thinks that his high-water alarm is blowing, and proceeds to reduce the supply on hand, when in reality it is the low-water alarm, showing that more water is wanted at once. It appears as if this was another of those cases where automatic appliances cannot fully supplant human intelligence, for when an alarm whistle sounds, it is the man's place to find out which boiler of a battery it belongs to and which alarm is being given. Failure to do this, showing lack of proper care and intelligence, should not condemn the whole system, nor any large portion of it.

Fig. 1 illustrates a combined water column and boiler-feed regulator in which a seamless copper float operates an ingenious valve, a slight movement of which starts or stops a pump if it is supplying but one boiler. Where several boilers are in use one of these regulators is attached to each, when by making a slight change in adjustment the device will regulate the feed for that particular boiler only. Furthermore, if through neglect or accident to the pump the water level is lowered too much, this valve is opened wide, causing a vigorous blast to be blown on the whistle shown. The same alarm is given if the water level is raised dangerously high.

Fig. 2 illustrates a combined safety water column and boiler-feed regulator intended for one boiler only. A large copper float that is held in place by guides, floats on the water surface and when the water level is approaching the high safety limit, it shuts a valve in the pipe, and stops the pump if necessary, or causes it to run very slowly if water is being evaporated constantly.

Fig. 3 shows a similar column and regulator except that it is designed for use on one boiler forming part of a battery in which case the rising float admits steam to the valve below the regulator chamber the effect of which is to close the feed valve for that boiler and maintain a constant water level so long as the pump remains in working order. If it fails to operate promptly, the whistle shown sounds an alarm. A whistle is more of a necessity on a good regulator than for an ordinary water column because in the former case with hand regulation of feed water, the matter is constantly in mind and any defect in operation is quickly noticed; but where the engineer, fireman or water tender does not have to do anything for months to keep the water level steady, the care of it is gradually thrown off, and this is true of the most careful men that can be found; consequently if any part of the apparatus fails to work, it is not noticed as soon as it would be where hand regulation is depended on, consequently a whistle is valuable.

Some engineers claim that valves in the pipe connections of water columns and feed-water regulators are dangerous, hence should be eliminated, but they do not tell how to repair a whistle, a gauge cock or a float if there is no way provided for shutting off the pressure. Of course, the boiler might be laid off for this purpose, and in some plants there are enough boilers to permit this to be done, but every plant is not so well equipped. The only objection raised to these valves is that the fireman may forget to open them and find out where his water level is before he commences to raise steam; but if a fireman forgets such an important part of his daily routine it will make no difference whether they are installed or not, so far as the water level is concerned, and if he proves the height of his water level by comparing the glass gauge with the try cocks, they can do no harm.

The two previous illustrations show combination water columns that are large in diameter, but are not high in proportion. This makes it possible to use large floats that exert much force if required to operate valves, but they do not show the water level in the boilers more accurately than much smaller specimens, as accuracy in this respect depends on large connecting pipes more than on the size of the column used.

Fig. 4 illustrates a steam pressure regulator to be used in connection with Fig. 3. It forms part of the steam piping for the pump and when shut off at night (or any other time when water is not wanted), the valves, 2 and 3, are closed. When the pump is wanted, 2 is opened until the desired speed is secured when 3 is opened and 2 is closed, thus causing steam to pass through the balanced valve, 4. Pressure from the main feed pipe is transmitted through 5 to the diaphragm, 6; therefore,

when all boilers in use have two gauges of water, the feed valves will close as already explained, thus creating a higher pressure in the feed pipe line, and as this operates on 6 it shuts off the supply of steam and stops the pump until more water is wanted.

Fig. 5 is an ingenious device for controlling boiler feeders which depends on the expansion and contraction of copper under changing temperatures, for its operation. The cast-iron water column, 2, is located so that the center of it is level with the water level of the boiler that it controls. It is connected to the steam space of the boiler by the pipe, 3, which may be connected into the regular water column pipe if convenient, provided there is no valve between the angle valve shown and the boiler. The bottom connection is made by means of the pipe, 4, which may be connected to the lower water column pipe, or tapped directly into the boiler below the water line. There must be a pocket or loop as shown in order to keep the lower pipe cool. A globe valve may be used or an angle valve be put in the place of the ell above it. The small pipe, 5, conveys steam to the auxiliary valve, 6. The copper pipes, 7, 8 and 9, compose what is called "the harp." Copper is used because its coefficient of expansion is high when compared with other common metals.

When the water level is low enough to fill the central pipe of the harp, it expands by the heat applied and closes the auxiliary valve, 6. Steam is now shut off from the pipe, 10, hence the spring in the main valve, 11, opens it and allows water to flow into the boiler as indicated by the arrow. When enough is secured to raise the water line to its proper place, the harp is cooled thereby, and as it contracts it opens 6, admits steam to 11, which acts on the large diaphragm and closes the feed valve. After steam has been used in 6 and 11, it is exhausted through 12 and 13, and is used to blow out the water column 2. While the above description shows possible changes under conditions given, in practice these changes seldom take place, because when once properly adjusted the regulator admits water to maintain a constant water level, thus giving continuous, instead of intermittent operation.

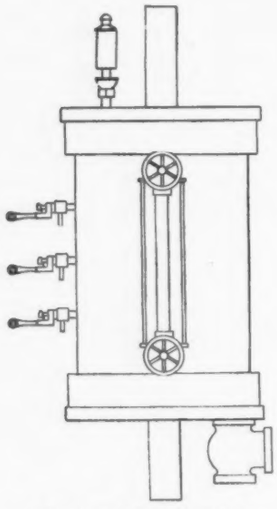


FIG. 3.—WATER COLUMN AND REGULATOR.

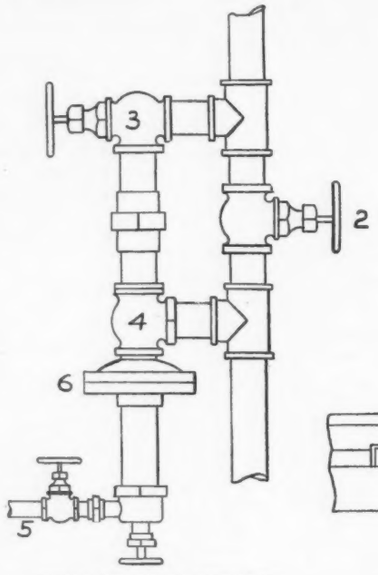


FIG. 4.—STEAM-PRESSURE REGULATOR.

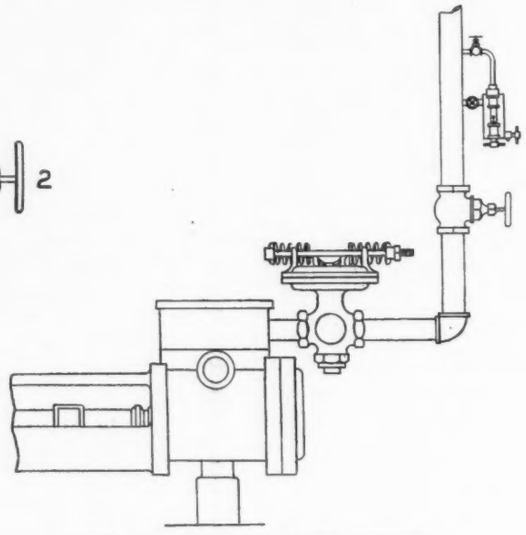


FIG. 6.—APPLICATION OF PUMP GOVERNOR.

Examination of previous illustrations presented, shows that the devices used for shutting off the supply of steam to pumps, cannot be utilized where the temperature is below the freezing point, as they would freeze and burst, but Fig. 7 is a pump governor that is actuated by live steam pressure, hence it cannot freeze. When this governor is not in use the spiral springs acting on the toggle levers hold the valve open, but when steam is admitted from the left-hand side it passes the double beat balanced valve, and from the right-hand side a portion of it goes up through the vertical passage and acts on the diaphragm.

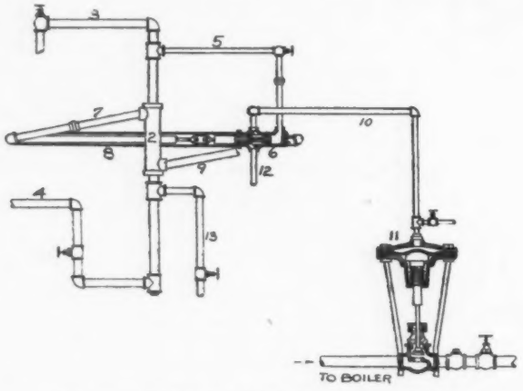


FIG. 5.—AUTOMATIC FEED WATER CONTROLLER.

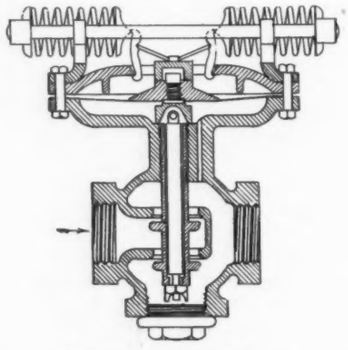


FIG. 7.—PUMP GOVERNOR.

Now the principle on which this governor acts is that a given steam pressure delivered to the pump will create a certain water pressure in the feed pipe, hence excessive pressure cannot accumulate here, for this governor can be set by means of the nuts at the outer end of the springs, and when the required pressure is secured the steam supply is shut off. As water cannot collect where it can freeze in this device, it may be used in very cold places, although it will pay to protect it from rapid radiation.

Fig. 6 illustrates an application of this regulator to a boiler feed pump showing its extreme simplicity, as no extra piping

is required. Suppose that the battery of boilers that this pump supplies, carries 100 pounds pressure and 110 pounds is required to force feed water into them. The regulator must be set at 120 pounds in order to make the supply sure, and it may require 70 pounds in the steam cylinder to give it. This will prevent the feed pipe, heater, etc., from being subjected to more than 120 pounds, even if all feed valves are closed at once. This pressure will be greatly exceeded at short notice where boilers carry 70 pounds pressure with an ordinary steam pump, provided it is not fitted with a regulator, if all of the feed valves are accidentally closed by hand. This is not a theory, as the writer has seen it demonstrated several times in ordinary practice, although a small relief valve on the feed pipe was open at the time.

Burning Fine Anthracite Coal.

By R. T. Strohm.

The desirability of using a low-grade fuel in the production of steam cannot be questioned, provided an ample supply at a reasonable price is available and the conditions are correct for its economical use. Freight rates and the cost of cartage add appreciably to the cost of a fuel, and are approximately constant for all grades, so that it is frequently found advisable to use a high-grade fuel of great evaporative power in preference to a cheaper low-grade fuel, since the better performance of the first more than offsets the lower cost of the second. Especially is this the case in districts far removed from the coal fields. The closer power plants are located to the centers of coal production, the greater is the opportunity for saving, due to the use of the cheaper grades of coal. For, these lower grades may be obtained without excessive transportation charges, at a price that will enable them to compete successfully with the better grades, of higher heating value.

In the anthracite regions, a considerable portion of the coal mined is finally separated in the finest grades, such as buckwheat No. 1, buckwheat No. 2, buckwheat No. 3, rice, barley and culm. The buckwheat varieties pass through ½-in to ⅛-in. meshes in screening, the others mentioned being smaller in size than the No. 3 buckwheat. Some collieries have two grades of barley, known as barley No. 1 and barley No. 2. The former is slightly smaller than buckwheat No. 3, and the latter is still smaller. No. 2 barley would doubtless pass over a screen having 5/64-in. meshes, and through ⅛-in. meshes.

Now, it is doubtful whether it would pay to use the sizes below No. 3 buckwheat at any great distance from the mines, but in and near the anthracite coal fields they have been used, and are at present being used, instead of the larger grades, and with better economy than could be attained by the use of the more costly larger sizes.

In substituting a low-grade fuel for one of higher grade, it is quite probable that a number of difficulties will be encountered, necessitating changes in the boiler setting, the draft appliances, the grate surface, and the like. But these things are to be expected.

In the first place, a greater amount of low-grade fuel must be burned per hour to furnish the same amount of heat as originally obtained by using a higher grade. This means more work on the part of the fireman, and consequently increased cost of labor, since it is unreasonable to expect a fireman to do from 30 to 50 per cent more work without an increase in pay.

It will also be found necessary to change the grates, so as to prevent the finer portions of the coal from falling through into the ashpit without being burned. The size of the coal used will determine the maximum width of air spaces allowable in the grates. The difficulty encountered in the use of a grate with very small air spaces lies in the small percentage of total grate area left open for admission of air to the fire. It is not feasible to make the metal portions of the grates of the same width as the air spaces, so as to give about 50 per cent of area for the passage of the air. Such a construction would result in a light and flimsy bar that would warp out of shape, burn easily and add largely to the cost of repairs. To make a serviceable grate for fine coal, therefore, it is necessary to cut down the air space to a small percentage of the total area of the grate surface.

If the same grate area were used for cheap fuel as has been used for high-grade fuel, the number of pounds of coal burned per square foot of grate would be greatly increased, resulting

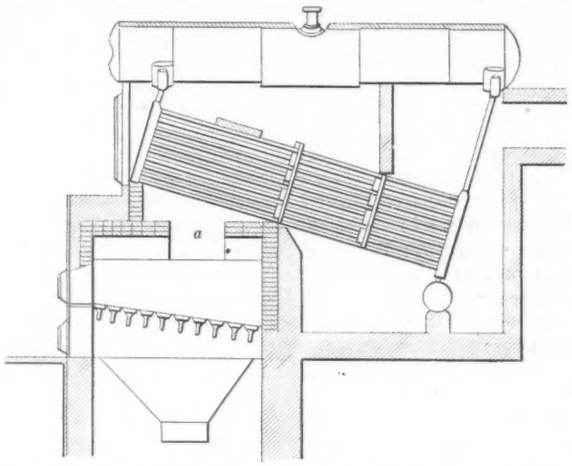


FIG. 1.—WATER TUBE BOILER EQUIPPED FOR BURNING BUCKWHEAT COAL.

in a deeper bed on the grates. Fine coal forms a mass which is far less easily penetrated by air currents than a much thicker bed of coarse coal. The close packing of the small coal, and the decrease in the area of air passages combine to make it a difficult matter to obtain sufficient air supply by natural draft alone. As a consequence, forced draft is employed in most cases where finely divided coal is used for fuel. At the same time the grate area is increased, in order that the rate of combustion per square foot may not become excessive. This permits a thinner bed of fire and better results from combustion. With too small a grate surface, the firing of fresh coal on any section of the grate will need to be very frequently repeated. The effect of these fresh charges is to deaden the fire temporarily, and when repeated at very short intervals, it may be found impossible to keep the boiler working at the desired capacity.

Illustrative of what has just been stated concerning the burning of the lower grades of coal, an actual instance may be cited. In the heart of the anthracite field there is a large electric power station devoted to railway work, in which a very small size of anthracite, known as barley No. 2, is used for fuel. The plant is so located that the coal can be hauled from the colliery to the boiler room over the railway lines of the company, and as the haul is a short one, the cost of the coal delivered at the boilers is very small, being in the neighborhood of 50 cents a ton. The fuel is delivered by belt conveyer to large storage bins above the boilers, from which it

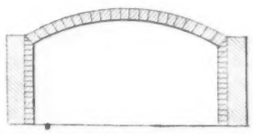


FIG. 2.—CROSS-SECTIONAL VIEW OF FURNACE.

flows through vertical chutes to the firing tables in front of the boilers. Manual handling of the coal is thereby confined to the firing of the boilers, hand firing alone being used.

This barley No. 2 is a washery coal, and is obtained from what are familiarly termed culm heaps. By means of a heavy stream of water from a hose, the material composing the heap is flushed down and run into conveyors by which it is carried to the washery. Here it is washed and separated from slate and dirt, and screened into the several smaller sizes. By this treatment the fuel is very wet, but it has opportunity to lose some of this moisture during its transportation and during

its passage from the cars to the bunkers and the chutes leading to the firing tables.

The quality of this fuel does not vary to any great extent from one season of the year to another. Air-drying of a sample taken from the firing table in front of one of the boilers showed that the moisture in the coal, due to the washing process, amounted to 13.7 per cent by weight.

Analysis of an air-dried sample of the coal showed the following composition:

Fixed carbon	73.57	per cent.
Volatile combustible	7.20	" "
Sulphur	1.55	" "
Moisture	1.40	" "
Ash	16.28	" "
	100.00	" "

The type of furnace used for the burning of this fuel is a modification of the Dutch oven. A longitudinal section of the furnace is shown in Fig. 1, and a cross-section in Fig. 2. It consists of a rectangular chamber with firebrick walls and a low arched top, also of firebrick. However, instead of discharging the hot gases from the furnace at a point immediately above the front face of the bridge wall, the outlet for the gaseous products of combustion is made at a distance of some 3 ft. from the bridge wall. The furnace thus has what may be termed a dead end.

Owing to the high temperatures it must withstand, the arched top of the furnace is made of high-grade refractory brick laid up with extreme care and precision. The rise of the arch at the

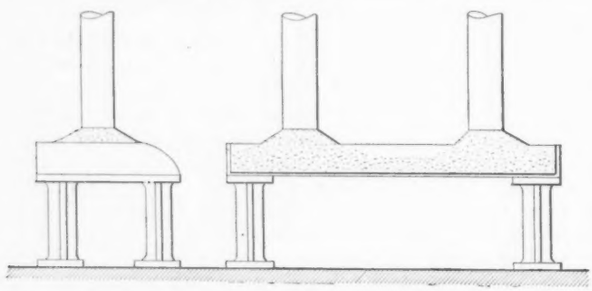


FIG. 3.—COAL CHUTES AND FIRING TABLE IN BOILER ROOM.

center is 18 inches. At the front it is 3 ft. above the surface of the grate, and at the rear, 4¼ ft. In numerous instances trouble has been experienced with arched furnaces, due to the loosening and dropping of sections of the brickwork. In the particular plant described there has been no difficulty of this kind, due, it is believed, to the greater care in construction and the employment of stronger and better materials than are commonly used.

The value of this construction lies in the fact that the gases are more thoroughly mixed and burned than would be the case with an opening just in front of the bridge wall. For there is a current of hot gases from the rear end of the furnace toward the opening *a* and a current from the front toward the same opening, and the conflict of these currents insures a thorough mixing. Moreover, the reverberatory effect of the dead end insures that the gases cannot reach the cold tube surfaces before combustion is complete.

The bed of fuel in the furnace is supported by shaking grates, which are operated by hand from the front of the boiler. The bars of the grate have air spaces about 3/16 in. in width, and the total amount of air space is equal to about 40 per cent of the grate area. On account of the fineness of the coal used, it is necessary to carry a deep layer of ashes beneath the incandescent portion of the fire, in order to prevent waste of fuel by dropping through the grates. At the front of the furnace the total depth of the bed on the grates is from 12 ins. to 14 ins., while at the rear end it varies from 5 ins. to 8 ins. The actual depth of the fire, however, varies from 3 ins. at the front to 2 ins. at the rear. The deep bed of ashes not only prevents loss of fuel, but it also increases the length of life of the grates by interposing a non-conducting layer between the incandescent coal and the grate surface. Carrying a hot fire directly on the top of a grate of this kind having necessarily small fingers would result in rapid burning and warping of the metal.

It is evident that to force air through a bed of ashes and burning fuel a foot or more in depth will require considerable draft pressure. The chimney of the plant is only 118 ft. high, and the gases in the stack have a temperature of 465 degrees F. With natural draft and an outside temperature of 60 degrees F., therefore, the draft pressure would be about .7 in. of water. This would be entirely too little for the fuel mentioned, as the finer grades of anthracite require a draft something like 1.25 ins. of water. Consequently, a fan is installed below the floor of the boiler room, and an air pressure of .7 in. of water is constantly maintained in the ashpit of each boiler. This, in addition to the chimney draft is sufficient to furnish the requisite amount of air for economical combustion.

In the air duct leading to each ashpit is a ⅜-in. pipe from which superheated steam is discharged into the air current when the boiler is in operation. The purpose of this injection of steam is to prevent the formation of clinkers which would clog the air spaces in the grate. The use of superheated steam for this purpose results in the formation of light, porous beds of ashes, finely divided and readily shaken through the grates.

There are three shifts of firemen, each working eight hours, all firing being done by hand. To facilitate the work, firing tables are used, one being placed before each boiler. These tables are merely cast-iron benches or platforms about 24 ins. above the floor level, and perhaps 30 ins. wide. Each is supplied with coal by two vertical chutes from overhead bunkers, as illustrated in Fig. 3. The distance from the boiler front to the edge of the firing table is about 6 ft., and the surface of the table is nearly on a level with the lower edge of the fire doors. Consequently, the fireman, standing midway between the table and the boiler, is not required to stoop or lift the coal scoop. He simply turns a trifle on his heel, rotating his body as he does so, and is thus enabled to do the firing with the least expenditure of energy.

No little skill is required for the economical firing of this fine grade of coal. It is necessary to have a thin bed of fire, and yet allow no holes, or spots where the coal is completely burned out. Each grate is 12½ ft. wide and 10 ft. long, with a downward pitch toward the rear end of 1½ in. per foot. There being three fire doors to each grate, the alternate system of firing is used. The coal thrown into the furnace is scattered, so that it is spread in a thin layer over considerable area. This is necessary in order to prevent deadening of the fire at any point.

The firemen are taught to use the dampers in the fire doors as an aid to combustion without smoke. Immediately after a fresh charge of coal has been fired, the damper is opened for several seconds, until the greater portion of the volatile matter has been driven off and burned.

The coal consumption per day of 24 hours is in the neighborhood of 65 tons, the major part of which is burned during the day time when traffic is heaviest. The amount of coal per hour, therefore, which each fireman must handle varies from one to two tons, according to the hour of the day. This means that the rate of coal consumption is from 10 to 20 lbs. per square foot of grate per hour.

Fires are cleaned but once during each shift, this being accomplished by shaking of the grates. The ashes fall into a car beneath the boiler, and are then taken by track and elevator to the outside of the station. The cost of removal is in the neighborhood of six cents per ton of coal. Analysis of ashes dumped from the car showed the following composition:

Volatile matter and water	1.45	per cent.
Fixed carbon	6.63	" "
Ash	91.92	" "
	100.00	

Comparing this analysis with the analysis of the coal, it will be seen that less than 5 per cent of the fuel is lost through incomplete combustion or dropping through the grates. Considering that in many instances where very small-sized grades of coal are used the loss of fuel through the grates amounts to 20 per cent and more, the above may be regarded as an excellent performance.

LETTERS ON PRACTICAL SUBJECTS.

AN UNUSUAL ARRANGEMENT FOR 60-CYCLE POWER SERVICE.

A company operating a four-wire, three-phase, 60-cycle, 2080-volt star, 3600-volt delta system was called upon to furnish service to a pumping plant which was equipped with 2080-volt three-phase motors. It was necessary to give this service with

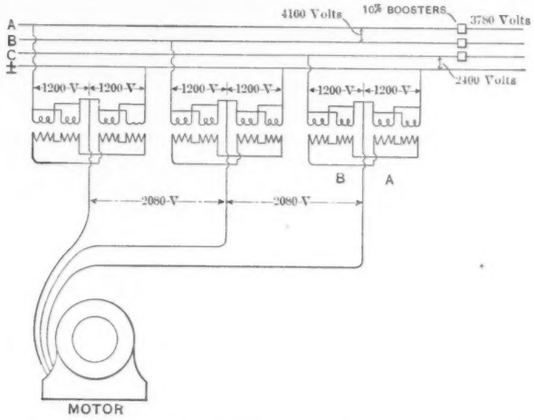


FIG. 1.—TRANSFORMERS CONNECTED FOR USE AS AUTO-TRANSFORMERS.

standard lighting transformers wound for 1040-2080 volts primary and 115-230 volts secondary. The largest transformer available was 50 kw, while 300-kw capacity was required.

The arrangement which first suggested itself is shown in Fig. 1, which represents three 50-kw transformers connected for use as auto-transformers, and one of the 2080-volt motors. The remaining 150-kw capacity was to be secured by a similar bank of transformers in parallel. The primary coils of these trans-

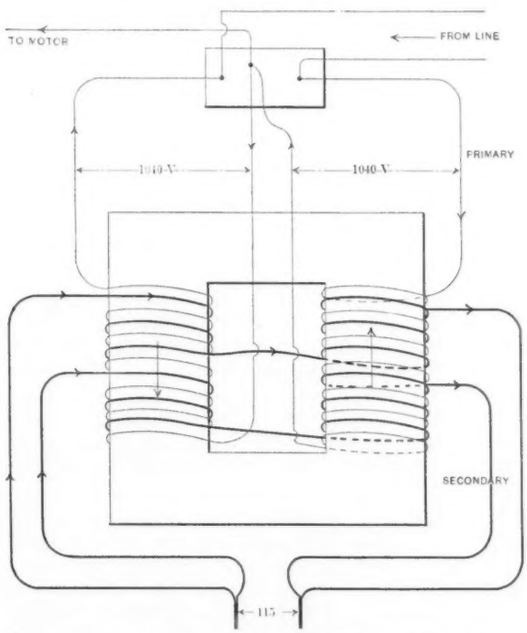


FIG. 2.—DIAGRAM OF TRANSFORMER CONNECTIONS.

formers were connected for 2080 volts, and boosters were provided to raise the pressure from phase to neutral to about 2400 volts, thus giving about 4160 volts between phases. The motor leads being tapped at the midpoints of the primary windings, the pressure impressed on the motors would be one-half of 4160 or 2080.

Upon attempting to start the motors with this scheme of connections it was found that the pressure on the motor terminals dropped to less than 1000 volts, and the motors refused to turn over. The secondary connections of the transformers had been placed in multiple so as supposedly to provide proper equalizing effect on the two halves of the transformer core.

After a number of trials the arrangement of the transformer coils and core was investigated and found to be as shown in Fig. 2. From this scheme of connections it is evident that it would be impossible for any equalizing current to flow, since the secondary winding is divided into four sections which are dis-

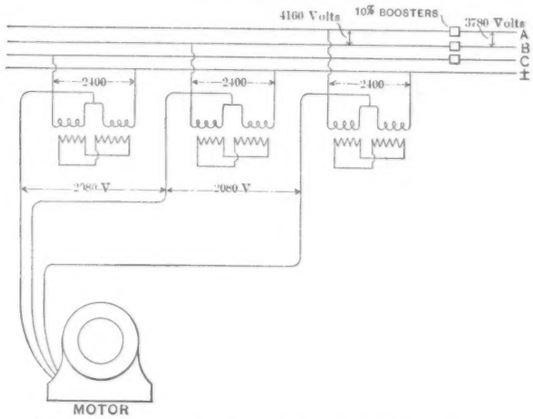


FIG. 3.—DIAGRAM OF FINAL CONNECTIONS.

tributed between the two limbs of the core in such a way as to prevent any interchange of current between the sections of the winding. The lack of balance in magnetomotive force between the two limbs of the core cannot cause any flow of current through these windings, and the primary merely acted as a choke in series with the motor. It was, therefore, necessary to secure this equalizing effect by means of the connections shown in Fig. 3, in which the transformers do not act as auto-transformers. Two transformers are placed in series, with primary coils connected in multiple. The secondaries are connected in series-multiple, thus maintaining the potential of the midpoint at which the motor is tapped. With this scheme of connections the motors started with good torque and without abnormal drop in pressure.

It is thought that this peculiarity of standard three-wire lighting transformers, while it is probably familiar to manufacturers, may be of interest to central station men who might have occasion to attempt to use such a transformer as an auto-transformer.

H. B. GEAR.

CHICAGO, ILL.

BLOW-OFF PIPES.

A steam boiler which supplied steam in a small electric light station, suddenly parted with that portion of the blow-off pipe which was screwed into the shell of the boiler. Of course lighting operations were suspended in a very few minutes after the occurrence took place and the good people of the community hunted up their tallow candles and kerosene lamps while the engineer vainly sought for some way of making temporary repairs sufficient to permit the boiler to be run through the night. But he did not succeed, and darkness had its own way that night.

The writer once went through a similar experience, and the lights were shut off just two hours. The water was allowed to all run out of the boiler—there was no way to stop it—then the fragment of the blow-off pipe which remained in the hole was driven out, or rather in, by means of a hammer and chisel, and the outside of the pad which was riveted to the boiler, was filed a little where the threads had raised the metal, and the sharp snags and corners were removed.

The pipe was 2 inches in diameter, the hole being nearly 2½ inches. Some cast washers were found in the store room,

and a piece of 1½ by ½ inch iron about 12 inches long was bent in the form of a long "U" with just enough space between the legs to admit a ½-inch bolt. Fig. 1 gives an idea of the manner in which the strain-bar was bent up, and Fig. 2 helps to make clear how the make-shift appliance was put over the

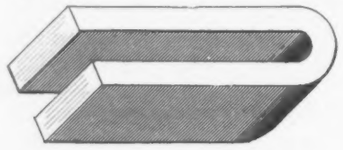


FIG. 1.—STRAIN BAR FOR INSIDE OF BOILER.

blow-off hole. As everything had to be "fished" through the pipe-hole, it may well be imagined that no chances were taken of the pieces getting out of reach one way or the other. To prevent such an occurrence, small wires were attached to the strain bar and to the bolt, before either was pushed through the hole into the boiler.

A couple of cut washers were placed above the strain-bar, just under the head of the bolt, to give as good a bearing as possible to the bolt head. A cast-iron washer, with a diameter great enough to cover the pipe-hole, was selected and smoothed up a bit with a file. To make a better fit around the bolt, a smaller cast washer was placed under the first washer, and several layers of asbestos packing were interposed between the washers, and between the washer and the boiler.

Another layer of packing was put over the end of the bolt, and a roll of candle wicking and graphite was placed close around the bolt and a close-fitting cut washer was placed against the last packing and the nut screwed home. Water was run into the boiler from a tank overhead, and a small stream of water was kept running most of the time, through the boiler, to prevent the heat from the brick work from heating the shell plates too hot. In fact, water from a hose was kept running through the boiler all the time, from the time the fires were drawn and the pressure relieved (by blocking the safety valve open) until the bolt was thrust into the boiler with the strain bar. The water was started again the instant the first cut washer was in place, and by the time the nut and the several packings were fully adjusted, there was ten inches of water in the boiler and the fires were lighted again.

By the time the fires were started, the water appeared in the bottom of the water-line glass and steam was raised in a few minutes more. Several of the tubes leaked a little as the result of so suddenly cooling the boiler, but no great damage resulted from the incident.

The new blow-off pipe, which was put in place next day, was made from heavier pipe. In fact, the very heaviest pipe obtainable was procured and the boiler piece was made therefrom.

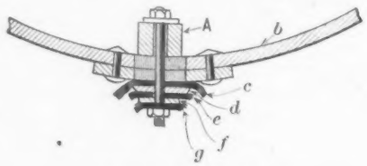


FIG. 2.—TEMPORARY BLOW-OFF REPAIRS.

The water has a peculiar action upon the metal in this boiler, wasting taking place wherever two pieces of metal join each other. Thus, there was severe thinning of the tubes where they enter the heads—much greater wasting away than is usually found in horizontal tubular boilers.

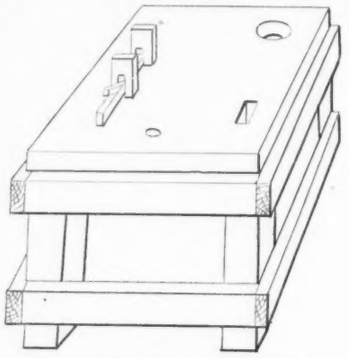
The same action was also observed wherever a pipe was screwed into a fitting. The ends of the pipes seemed to be the only parts attacked, the middle of the various pipes and tubes being seemingly in excellent condition, while the ends were so wasted that new tubes have to be put into the boiler much more frequently than is usual. Some of the old tubes seemed nearly as thin as paper, and the blow-off pipe was surely in the same class.

Another engineer, who got caught in a similar manner, kept the lamps burning with only about 100 minutes shut-down, by clearing out the blow-off hole and then driving a hardwood plug into the hole, using a heavy sledge, and driving the plug as far as possible. The dirt was cleaned out directly beneath the hole in the boiler, and a heavy plate of iron was laid down and bedded carefully in the cleared space and a bar of iron—an old grate bar, in this case—was driven solid between the bedded plate and another close-fitting iron covered with packing which was placed underneath the plug. A round, flat iron was placed between the bar of iron and the plug, and after the bar was driven home the job proved water tight, and the engineer quickly fired up and got the lamps burning again.

New York City. James Francis.

REPAIR-SHOP FACE PLATE.

Among the repair tools, the writer noted an iron plate, about 30 ins. by 30 ins. by 3 ins., mounted on top of a heavy wooden frame of 6 ins. by 6 ins. stuff, and furnished with large casters



REPAIR SHOP SURFACE PLATE.

so that it might be easily moved from one forge to the other, as desired. This plate was fitted with a clamping device with which a man was bending 6 in. by 1¼ in. iron into all manner of shapes.

Columbus, Ohio. J. F. Hansen.

UNIVERSAL SOLDERING FLUID.

A soldering fluid made up in this shop is used for almost every kind of soldering which comes along. The linemen use it too, and it is possible to solder greasy, dirty connections, also to unite iron and most other metals with this fluid, which is made up by "killing" two quarts of muriatic acid with all the zinc it will take up. Then, there is added to the acid a quart of water (this may have to be added before the zinc will fully dissolve), and a quart of glycerine previously mixed with one quart of alcohol. This fluid has stood the test of all kinds of soldering, and its users are loud in their appreciation of its many good qualities. It is claimed that the glycerine prevents all rust action which is so common with many soldering fluids containing muriatic acid.

Buffalo, N. Y. Robert McFarley.

NEW RULE FOR FINDING THE DIRECTION OF CURRENT IN A CONDUCTOR MOVED IN A MAGNETIC FIELD.

The following rule for ascertaining the direction of current flow in an electrical conductor or in the armature of a generator, was submitted by the writer while studying at Karlsruhe, Germany, to Professor E. Arnold. The rule is exclusively used in Professor Arnold's standard work entitled "Die Gleichstrommaschine," and reads in German as follows:

"Der Strom tritt au(S) unter (S)üdpol, und ei(N) unter (N)ordpol."

It is plain that the last letter of the word "aus" and the word "ein" designates the poles. The same rule in a somewhat modified form also holds true in English and reads as follows: (see Figs. 1 and 2.)

"I(N) under a (N)orth pole and "OUT" under a s(OUT)h

pole" clockwise rotation or movement of the conductor to the right being taken for granted. The first half of the rule relating to the direction of current under a north pole, would in itself

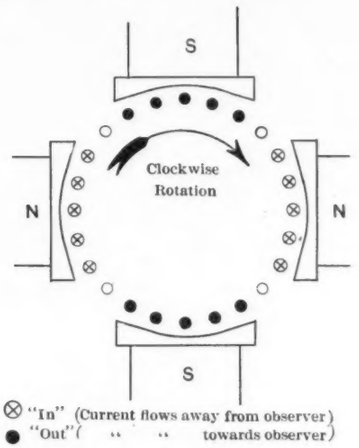


FIG. 1.—DIRECTION OF CURRENT UNDER POLES.

be sufficient; but the curious fact appears that the three middle letters of the word "south" give the direction of current under a south pole. Other rules, requiring certain setting of the

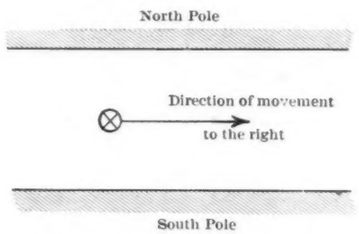


FIG. 2.—DIRECTION OF MOVEMENT.

fingers, etc., are more or less complicated and inconvenient. The rule here given has the advantage of being very simple and will not easily be forgotten.

EAST PITTSBURG, PA. H. A. STEEN.

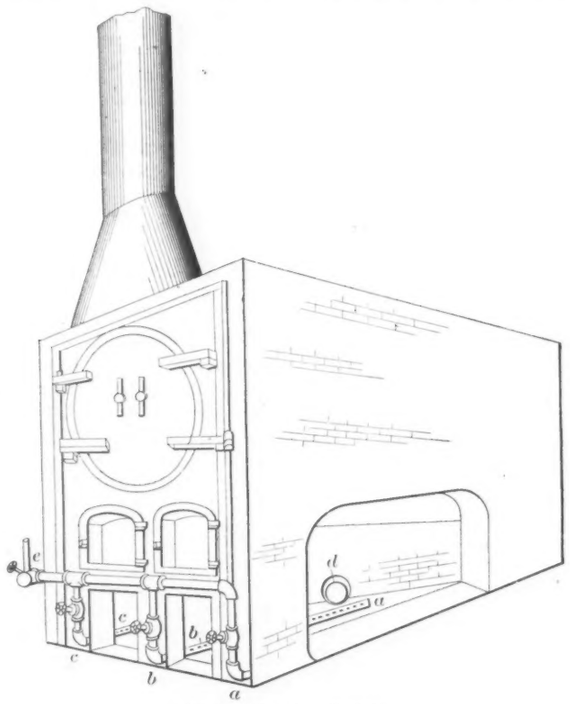
WASHING ASHES.

For a good many years, firemen have pulled ashes out from under the grates with a hoe, then shoveled the refuse into a barrow and wheeled it away—back-breaking work at best and work which often had to be done when there was no time which could well be spared for it. A scheme recently worked by an engineer in this State looks good to me and engineers will do well to go after it whenever surrounding conditions will admit. And in a good many instances, the method, or a modification of it, could be used as well as not.

The bottom of the ash pit was built as shown herewith, lowest in the center, and at the back end, with three water pipes placed as shown, at *a*, *b* and *c*. The pipes *a* and *c*, were ¾ in. in diameter, while pipe *b* was 1 in. through. In the installation above noted, the main pipe was only 1¼ in. in diameter—too small to supply the three pipes which are connected with it. The writer has increased the diameter of supply pipe *e*, making it 2 in. in diameter. The three valves shown at *a*, *b* and *c* were also added by the writer, as they do not exist in the original construction, but their want is much apparent, as will be noted later.

The pipes, inside the ash-box, are perforated with the necessary number and size of holes to equal the cross-sectional area of the pipe, and the supply pipe *e*, is connected to a service pipe, either to the city or to the boiler feed pump, as the location may make necessary. When the fireman desires to remove the ashes from beneath the grate, he has only to open valve *e* and water of upwards of 60 lbs. to the square inch is turned into the pipes beneath the grates. The result is the ashes are washed from the sides toward the lengthwise center of the ashpit, and there meet the stronger streams of water from the 1-in. pipe. The ashes and containing water are forced to the back of the pit, which, as stated, is made V-shaped and lowest at the back end, where a pipe, *d*, made of ordinary cement sewer or drain tile, is placed. This pipe leads to the outside of the boiler house, and, if on a sidehill, nothing is necessary save to let the ashes wash out of the pipe and build out level with the bottom side of the discharge pipe. The ashes come out in a hurry. One-half the time that it has taken to read the above is more than is necessary for the complete removal of any ordinary amount of ashes from beneath the grates. Of course, if the ashes have been neglected and allowed to accumulate in considerable quantity, it is possible to choke pipe *d*, and cause trouble at that end of the line.

It was for the above stated reason that the three valves are added by the writer. By their use the fireman is enabled to wash out one side of the pit at a time, and in case of an extra large accumulation, he can use first, only the middle valve *b*, and wash a channel in the middle of the pit before the ashes from the sides are brought down. Then the side streams may be added as the condition of the ashes may warrant, and the pit cleaned quickly with no danger of clogging the discharge pipe *d*. For another reason, the three valves are also a necessity. It may happen that the water pressure is very low, so much so that it will not come with force enough to fully flush all three of the pipes. In this case, one pipe at a time can be used, the



ASH-REMOVING RIGGING.

same as where there is the heavy accumulation of ashes as already noted.

The disposal of the ashes after they have passed out of the discharge pipe, *d*, depends entirely upon local conditions. In some cases, they can be allowed to accumulate where they fall. In other localities, where there is at least 1 ft. between the ground level and the lower edge of pipe *d*, the ashes may be allowed to drain and then be carted away or otherwise disposed of. If possible, where the ashes have to be carted, construct two bins, the larger the better, watertight and fitted with means for drawing off any water that may be found inside.

To use these bins blow ashes into one of them until it is full of water. Do not allow it to run over, but let the bin or tank

rest until its contents have settled so that the water on top of the ashes has become clear. Then quietly open the valve and let off the clean water. In cases where some of the ashes may go away with the water without causing damage, then it may be possible to let the tank fill with water, and run over. In this case, the heavier portions of the ashes will remain in the tank while the water and the lighter portions of the ashes pass off.

After a tank has been filled with ashes as high as practicable, turn the discharge into the other tank or bin, and allow the contents of the first bin to dry out enough that they may be decently handled, after which they may be carted or otherwise disposed of. Where water is plentiful, the attendant can with good results, allow the water to run all the time. This will keep the ashpit nice and cool, thereby making the grate bars last a very long time.

With the arrangement as shown by the engraving herewith everything will be washed out of the ashpit, which can get through the discharge pipe *d*. All the clinker may be pushed right into the ashpit, and the streams will take good care of it. Care must, of course, be taken to break up any large clinkers which could not go through the discharge pipe, but everything else will be washed through in a hurry.

Willoughby, Ohio. James F. Hobart.

GROUND DETECTOR FOR THREE-PHASE CIRCUITS.

In its simplest form, the three-phase ground detector shown in Fig. I, requires three transformers. These are of the type generally installed in connection with switch-board instruments and should have a capacity of about 40 watts. The primary side should be wound for the bus-bar or feeder voltage, and the secondary side should be wound for any incandescent lamp voltage. Suitable fuse blocks should be interposed between the transformers and the bus or feeder circuit to which they are connected. Fig. 1 shows the diagram of connections. From this it will be noticed that the transformers are connected Y-fashion with the neutral grounded and with an incandescent lamp connected to each transformer.

The transformers may be supported on a side wall from brackets made of strip iron and secured to the wall by expansion bolts. A strip of hardwood supported directly in front of the transformers has the lamp receptacles fastened to it and is arranged conveniently for the electrical connections. The secondary wires may also be bunched in a cable and run to the lamps, which may then be located wherever desired. Assuming a bus or feeder potential of 1150 volts and the transformers to be wound for 1150-115 volts, each lamp should receive $115 \div \sqrt{3}$ or 66 volts; and if 115-volt lamps are employed they would burn with a dim light. If now a ground should occur on any line,

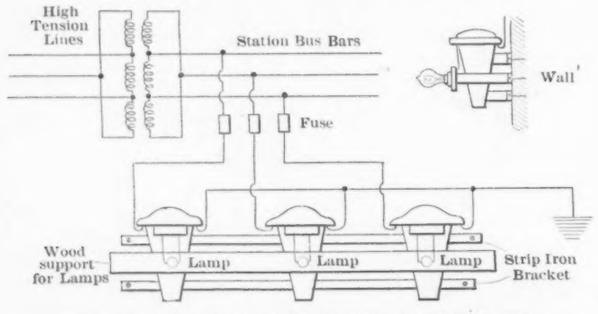


FIG. 1.—GROUND DETECTOR FOR THREE-PHASE CIRCUITS.

the corresponding lamp would be extinguished and the other two lamps still burn with a dim light as before.

If there is a high-tension transmission line connected to the bus through step-up transformers, or in case the ground detector is used on a feeder supplied from a high-tension system through step-down transformers, the ground detector here described has the additional advantage of indicating the condition of the high-tension system, not only as regards a dead ground, but also as regards heavy leakage. This is because any abnormal condition on the high-tension system will cause an unbalancing of the secondary voltages impressed on the lamps. As the leakage increases, the lamps vary more and more from their normal condition of dim burning, until a ground occurs. This will be indicated by one lamp burning at full brilliancy. The second lamp (assuming the same voltages as above; that is, 115-volt lamps receiving 66 volts) will not be quite as bright as normally,

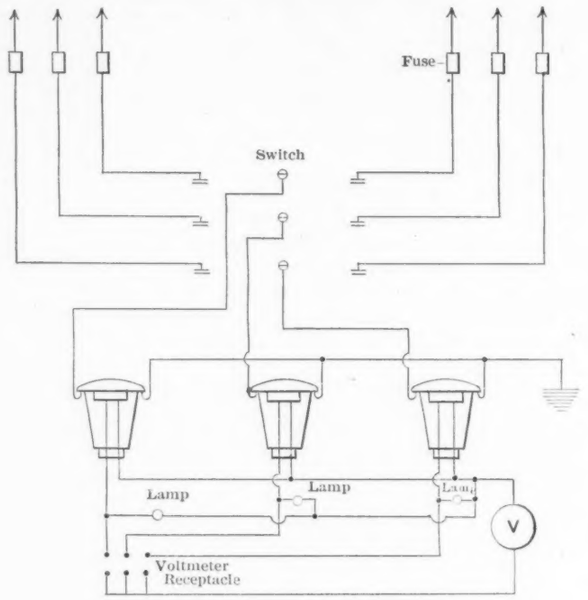


FIG. 2.—GROUND DETECTOR FOR THREE-PHASE CIRCUITS.

receiving only about 57 volts, and the third lamp will be to all appearances extinguished, the voltage on the lamp being approximately 15 volts.

In Fig. 2 is shown a more elaborate ground detector, involving the same principle and having in addition a voltmeter with plug and receptacle for ascertaining the voltage on any lamp. There is also a three-pole knife switch to connect the ground detector on either of two sets of bus-bars. The addition of the knife switch renders the device unsuitable for installation as an additional panel to the switchboard, as in case of a bus potential of 115, or 2300 volts, it would require the running of leads from the bus-bars to the switchboard, which of course, would be objectionable and dangerous. It would be better to select a location near the bus-bars and arrange the device with a view to preventing accidental contact with the bare parts of the switch. Should it be desirable to have the lamps and voltmeter on the switchboard, the transformer and the switch could be located in a convenient place and the secondary wires run as a cable to the switchboard. Voltages up to and including 2400 should have a switch with blades spaced about 5 inches and the contacts separated by slate or marble barriers. While the current is so small that any tendency to arc would be absent, a switch of this kind would not be suitable to open in case of trouble in the transformers, and the fuses, especially if the bus-bars carry a large amount of power should be absolutely reliable.

A slight variation in the brightness of the light does not indicate serious trouble. For instance, on a 15 or 20-mile transmission line having a potential of about 25,000 volts, wet weather may cause the voltage on one lamp to vary 25 per cent. This would disappear when the line became dry again; but should such a variation occur in good weather, it would probably indicate a permanent leak and an effort should be made to locate the trouble and remedy it before it became worse. Unfortunately, the writer has not had an opportunity to note the performance of this detector for a specific case of trouble that developed gradually, such as the burning off of a pin or cross-arm. Of course, no general rule can be given for any specific case and only observation and a complete record of previous

troubles will enable one to judge the extent of the trouble causing a certain variation.

Grounds on the high-tension side may easily be distinguished from those occurring on the low-tension side; because the high-tension trouble always causes a rise in voltage on one lamp. The writer has had very little opportunity, as yet, to observe the performance of this detector in comparison with the ordinary form of static ground detector during real severe lightning disturbances; and while he knows that the one standard make of static ground detector with which he has had actual experience, is all right so far as indicating a ground is concerned, he has seen on the other hand quite a number of them blown to atoms by lightning discharges jumping from a stationary vane to the moving element which is grounded, passing thence to a stationary vane on another lead and causing a disastrous short-circuit which interrupted the service and disfigured the marble panel.

CHICAGO, ILL. FRANK E. CONRAD.

SOME PRACTICAL ELECTRICAL KINKS IN TUNNEL WORK.

In the tunnels for the Pennsylvania Railroad across New York City, after the rock is blasted, it is loaded by shovels into specially constructed steel buckets on flat cars. These are made up into trains and pulled back to the shafts by 10-ton electric mine locomotives, each of which is equipped with two 40-hp motors. A loaded car weighs about five tons and the number of cars per train varies from four to eight. Since all the motor circuits are taken from the outside wires of the New York Edison Company's three-wire system, the neutral of which is grounded, it was necessary to use a double trolley.

Cable reels are used on the locomotives, so that they can run up into the headings beyond the end of the trolley which has to be kept back 150 ft. from the headings to avoid the danger of being struck by stone from a blast. To avoid the delay which would have been caused by a change from cable reel to trolley poles at each end of the trolley line on every trip, and also to save the extra copper and labor necessary to install and main-

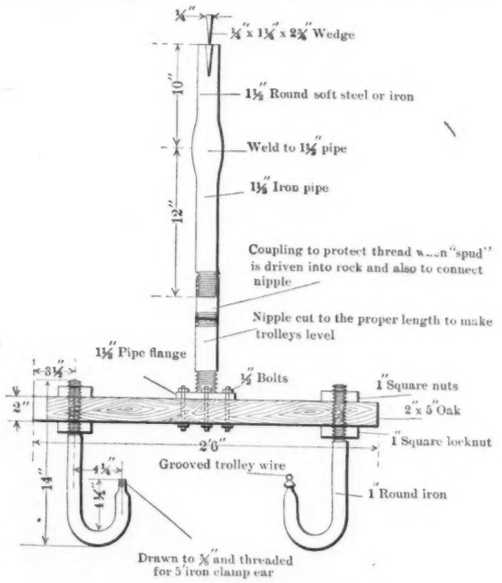


FIG. 1.—HANGER COMPLETE.

tain a double trolley over each of the tracks which in the course of the work is frequently moved, a special trolley system is used.

A "spud" consisting of a piece of 1½-in. round iron welded onto a short piece of 1½-in. pipe, is made fast in the rock roof of the tunnel by means of a wedge in the end, as shown. On being driven into the hole, the wedge strikes the top, causing the iron to spread and take a firm hold in the rock. On this is screwed the fixture carrying the trolley wires.. This fixture consists of a piece of 2-in. x 5-in. x 2½-in. oak on which is bolted the two hooks made of 1-in. iron and threaded at the ends so that the clamp ear may be screwed on. The grooved trolley wire is placed in these.

In Fig. 2 is shown a special "carriage" which runs on top of the trolley wires. A special wheel with a very wide groove is used, so that there is no trouble due to the wheel slipping off. The current is taken from the wheels by a strip of spring

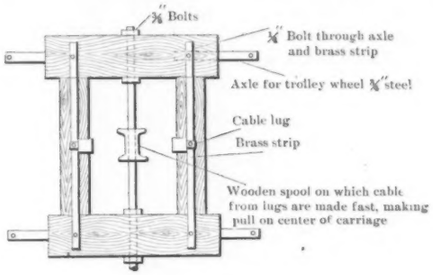

⅜″ Bolts
¼″ Bolt through axle and brass strip
Axle for trolley wheel ¼″ steel
Cable lug
Brass strip
Wooden spool on which cable from lugs are made fast, making pull on center of carriage

FIG. 2.—CARRIAGE.

brass, not shown in the engraving, which presses against the side and also through the axles. The two cables from the carriage are taped together into one and connected to the cables on the reel. The trolley is carried down the center of the tunnel and the flexible cable allows the locomotive to run on any track.

On the last trolley fixture, shown in Fig. 3, is placed a piece of angle iron, which acts as a stop for the carriage. When the locomotive reaches this point, the reel begins to unwind its cable and the locomotive continues into the heading beyond the end of the trolley. At a convenient height, special copper hooks are inserted in the cable, so that if it is necessary for two locomotives to pass each other, which is seldom the case, the carriages may be easily and quickly interchanged.

The Edison three-wire system is carried to within 200 or 300 ft. of the headings. Two No. O B. & S. rubber-covered cables form the outside legs of the system and the neutrals consist of a No. 2 cable. These are protected in the shafts by rigid iron conduit, and in the tunnel are supported every 30 ft. by three glass insulators on oak brackets which are nailed one above the other on a piece of 2-in. x 4-in. spruce wood fastened securely to the rock on one side of the tunnel and about 8 ft. from the bottom.

Light is obtained from four 16-cp incandescent lamps arranged in clusters and fitted in weatherproof sockets. The lamps are equipped with a conical shaped tin reflector and are tapped to the feeders at intervals. The clusters alternate from one side of the neutral to the other, so that the system is kept well balanced. From the ends of the feeders a piece of "hemp

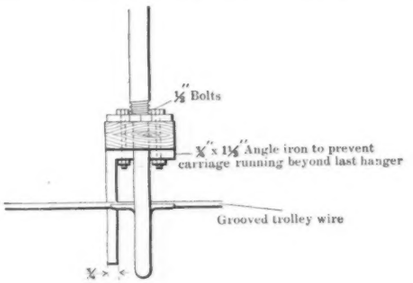


FIG. 3.—END VIEW OF HANGER.

portable" consisting of two wires, each composed of 28 strands of No. 28 wire, made up into a very flexible cable, is run up into the headings where arc lamps as well as clusters of incandescent lamps are used. This cable, which is wound with a hemp center and is heavily insulated, is very tough and withstands very well the rough usage to which it is subjected in the headings. It is easily coiled up and taken away whenever the blast is to be fired. The other features of the tunnel have already been described in the technical press.

NEW YORK CITY. W. C. LANCASTER.

QUESTIONS AND ANSWERS.

In a three-wire two-phase system having a potential of 2500 volts between either outer and the middle wire, what will be the potential across the two outer wires? J. B.

The potential across the outer wires will be $2500 \times \sqrt{2}$, or 3535 volts.

Kindly print a formula for paint for block iron fixtures; also a formula for frosting incandescent lamp bulbs? A. E. W.

Use drop black mixed with turpentine or with shellac for iron fixtures, where a dead black finish is desired. Formulas for frosting incandescent lamps were printed in the Question and Answers column of the December, 1906, number.

Is it good practice to run the ground wire from a lightning arrester through a ½-in. pipe, provided the wire is not connected to the pipe? C. S. D.

This is sometimes done to protect the wire; but since the iron pipe surrounding the wire makes the circuit inductive, it would be better to drive the pipe into the ground and connect the wire to it, thus making the iron pipe a part of the ground wire from the arrester.

If a three-phase generator supplying an induction motor load, suddenly increases or diminishes in speed, what happens to the speed of the motors? T. F. E.

Induction motors will always respond to changes in speed of the generator supplying them, because the speed of the rotor must bear a certain relation to the rate at which the magnetic field of the stator revolves, and the speed of the rotating magnetic field is in absolute synchronism with that of the generator supplying it.

A switch placed beyond a meter connected to a 60-cycle, 110-volt circuit, sparks at the contacts when opened, although no lamps are burning. What is the cause? Why are voltages in even multiples of 11 such as 110, 220 and 440 so much used? G. H. L.

The spark noticed when opening the switch on a circuit under no load is due to the inductive kick from the shunt coil of the meter. The choice of 110 volts is usually credited to Edison, who arbitrarily chose 100 volts and added 10 per cent to compensate for drop, so that the original Edison dynamos were built for 110 volts. This finally became the standard practice. The use of 220 and 440 volts naturally follows in the three and five-wire systems.

Where would be the place to look for trouble when a compound-wound generator drops in voltage when the load is cut off? D. E.

A compound-wound generator is supposed to drop in voltage when cut out of circuit. The effect of the compound winding is to increase the voltage as the load increases, so that when the load decreases the voltage necessarily decreases. If the compounding is too strong, so that the voltage rises too high from no load to full load, this can be corrected by decreasing the length of the shunt strip which is connected to the terminals of the series winding, provided the machine is not running in parallel with others. If there are several machines operating together, then the shunt strips of all must be shortened.

Kindly inform me how an electric dynamite cap is made, how much current it will take to explode it and what kind of battery to employ? J. G.

A low-tension electric detonator consists of two wires well insulated and terminating in the detonator where they are joined together by a bridge of fine platinum wire embedded in a flashing mixture adjoining the detonating compound. The passage of the electric current heats the platinum wire, the mixture is ignited and the detonator explodes. In a commercial type of igniter, the current required to heat the platinum wire is over ½-ampere and this can be obtained from a single dry cell. However, it would be better to use two or three dry cells in series in order to obtain sufficient e. m. f. to force the current through the circuit which must necessarily be of some length. The ignition will also be more reliable.

In a constant current transformer, such as is used on alternating-current series arc lighting circuits, does the magnetic flux follow the iron circuit exclusively at all times; or with the secondary short-circuited and normal voltage impressed on the primary, is the greater part of the flux choked out of the short-circuited secondary and forced to find a path through the air between the limbs of the core? F. R. K.

Constant-current transformers depend on the magnetic leakage between the primary and secondary coils for their regulation. Thus, independent of the position of the coils, the primary and secondary currents at all times bear a practically constant ratio to each other. When the coils are close together the opposing m. m. fs. of the two currents produce very little leakage lines; but when the coils are widely separated, the paths for the leakage lines are increased in value, and the lines which the secondary surrounds are less than when the coils are quite near each other. Since the e. m. f. generated in a coil depends on the strength of the magnetic field which it surrounds, any change in this field necessarily varies the e. m. f. generated in this coil, in precise proportion.

We have recently purchased a second-hand, 50-cycle revolving-armature alternator. Our present system is 60 cycle; but we have been informed that the frequency of the alternator may be raised by increasing the speed to 720 r. p. m. Will the armature stand the additional stress, and what will be the electrical characteristics? R. L. A.

The alternator is probably built with a considerable factor of safety, so that a 20 per cent increase in the rotative speed could probably easily be withstood. The results, mechanically considered, from operating the machine at the excess speed would be to decrease this factor of safety. It might be well for you to ascertain the exact factor of safety allowed in designing the machine; but it seems safe to assume that a 20 per cent increase will not be excessive. If, when the speed has increased to this amount, the voltage is to remain the same as before, it will be necessary to decrease the field excitation. When the field is weakened, the delivered voltage of the machine will be more sensitive to change in load; that is to say, the regulation will be much less satisfactory. It is doubtful whether the normal voltage can be maintained with entire satisfaction when the speed is increased 20 per cent. If, however, the voltage is increased, say, by from 12 to 15 per cent with an increase of speed of 20 per cent, the field will need to be only slightly weakened, and the regulation will doubtless be satisfactory.

With a heating system for a building heated by exhaust steam from the engines, is the coal consumed less when the engines are running under lighting load, then when the engines are not running and the building is heated by live steam? In other words, can the building be heated and lighted with less fuel than it takes to heat the building with live steam? D. M. A.

If the above statement were true, a part would be greater than the whole. This is not the first time that the same matter has been brought to our attention, and we believe the fallacy is due to the fact that people expect to find a very large difference in the effect of heating from exhaust and from live steam. The difference is really so small that in the absence of exact measurements it may disappear, or in the case of inexact measurements, the advantange may appear on the side of exhaust steam. In the ordinary non-condensing engine, only about 5 per cent of the energy in the boiler steam is transferred into work, 95 per cent of the heat thus appearing in the exhaust steam. Therefore, if the effect from exhaust steam heating is proportional to 95, the effect from live steam will only be proportional to 100. One can thus easily see that if on one day a building is heated with live steam alone, and on another day with exhaust steam alone, a difference in outside temperature that may escape notice or a difference of conditions with respect to wind, might appear to give the advantage to exhaust steam heating. In fact, we doubt if in the case of a house using, say, 400 pounds of coal a day, a difference in the heating could be observed over another day similar with respect to temperature and wind, if 5 per cent less, or say, one shovelful of coal less were used on the second day in the steam heating furnace.

CENTRAL STATION SALE OF CURRENT

Electric Signs in Buffalo.

BY GEORGE W. AMES.

That electric publicity is the touchstone to fortune in any line of business that appeals to the buying public, is a fact fast becoming as well recognized in Buffalo as elsewhere, and no one feature of electric advertising has of late made such rapid strides in public favor in the latter city as the electric sign, as now made and adapted to so many conditions.

The public has been quick to appreciate the advantages of the electric over the old-style, non-electric sign whose usefulness at best is limited to only a few out of the twenty-four hours.

FIG. 1.—ARTISTIC DEPARTMENT STORE SIGN.

The former, while it does most effective service during the day, is in addition an incomparable trade compeller during the hours of darkness, when thousands of pedestrians throng the business streets, a large percentage of whom must do their buying after their day's employment is finished.

The Buffalo General Electric Company in building up and carrying on the business of its sign department, has persistently and patiently followed out a carefully planned system of work—a work of making plain the value and trade-winning power of this particular form of electric publicity. The company has not followed any old style, stereotyped form; but by means of the personal attention, argumentative and demonstrative methods, supplemented by liberal treatment of the customer, has achieved most satisfactory results, valuable alike to both company and consumer.

FIG. 3.—ELECTRIC SIGN FOR JEWELER.

FIG. 2.—MAIN STREET, BUFFALO, BY NIGHT.

Sign literature, attractive in form, convincing in statement, liberally and regularly circulated, has been found effective and

productive of substantial results. In the prosecution of this campaign, the field has not been confined to too narrow boundaries, since sign advertising, in one form or other, seems limited to hardly any line of trade or manufacture. The electric sign

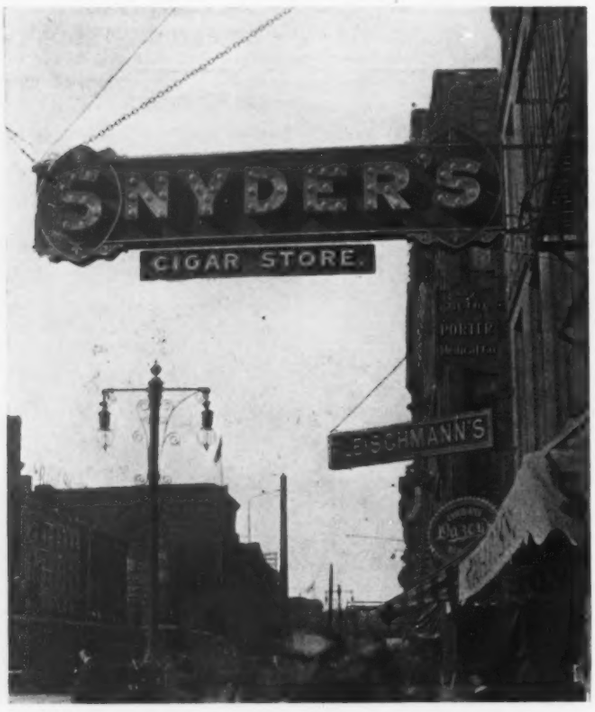


FIG. 4.—ARTISTIC DAY AND NIGHT SIGN.

has proved to be a self advertising feature of electric lighting service and the time is not far distant when it will eventually replace the old style non-electric sign, that must perforce quit work at sundown.

The method of advertising and reaching sign trade in Buffalo is worked out on a principle of direct appeal to probable sign customers, together with the mailing of literature as before noted. This is supplemented by a fair amount of space devoted to the sign question in *Current Talk*, a monthly publication issued by the company and found to be a most valuable feature in increasing all lines of central station business. A strong argument and one that is found generally to be of weight, is

FIG. 5.—ELECTRIC SIGN FOR CLOTHIER.

based on the great value of sign circulation; that is, the number of people within range of the electric sign nightly between the hours of six and ten. This circulation is equal, if not greater than that secured by any other form of publicity, such as newspaper advertising, bill-board advertising, etc. In addition to this night circulation, it is impressed upon the mind of the prospective customer that a properly constructed electric sign is also a most attractive and impressive day form of publicity; in fact, quite the equal of the old style non-electric sign.

FIG. 6.—VERTICAL INDIVIDUAL-LETTER SIGN.

A consideration of the day efficiency of the electric sign brings up a most important feature to be reckoned with in sign construction, that is, the avoidance of the "stock pattern" style of sign so frequently used and so often as little adapted to the

FIG. 7.—ORDINARY DAY SIGNS AND ELECTRIC SIGN.

given conditions and surroundings as a square peg is to a round hole. The signs installed by the Buffalo General Electric Company are types of artistic design both as regards form and color. Every effort is made to vary the plan and design in each

individual instance. A contour and finish pleasing to the eye, attractive and striking, yet in good taste, is sought after and the results have been most satisfactory. As will be noticed in the accompanying engravings the "stock pattern" idea is wholly avoided. In all cases original water color designs are submitted and these are made to fit the conditions of the place, the advertisement and the business.

Very little time is required in sign work to show the intending purchaser the value of the electric sign as an adjunct to street

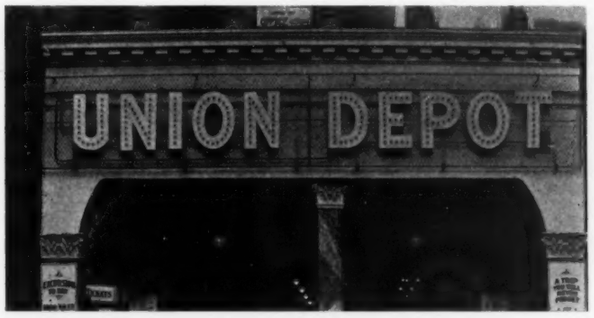


FIG. 8.—SIGN FOR AMUSEMENT RESORT.

lighting. The more signs, the more brilliantly the street is lighted and the stronger its drawing power, for the crowd like the individual is attracted by light and repelled by darkness. If, as has been so often claimed, an arc lamp is as good as two policemen, how much more of a peace guardian is a brilliant electric sign using from one hundred to two hundred lamps?

The actual sale of signs is naturally the business of the sign department. The reports of all solicitors in the contract department on their calls, either as results of the advertising methods mentioned or from any other source, are collated, indexed and recorded in that department, and then so far as it pertains to signs, a record is given to the sign department for its purposes and work. In this work, which is largely educational, familiarity with conditions, not only of manufacture and sale, but the purchaser's needs and limitations, counts very largely for or against obtaining the order. A very important factor in sign trade development is necessarily the attitude of the lighting company on the matter of installation. A liberal policy in this regard has done much toward the use of electric signs in Buffalo and is an esential feature in the practical consideration of the sign situation.

One point in advocating its work is never lost sight of for a moment by the sign department; namely, that electricity is

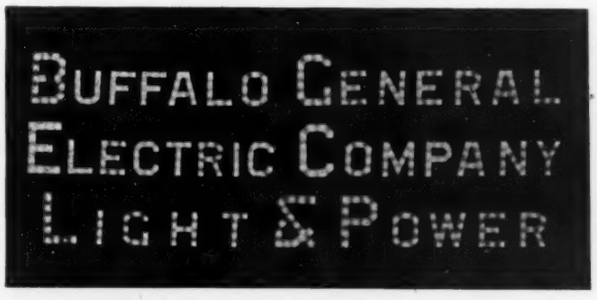


FIG. 9.—ONE OF THE ELECTRIC COMPANY'S OWN SIGNS.

no longer a luxury, but a necessity; quite as much so at present day conditions of business as well as social life, as food and clothes. It is quite as needed a means of publicity for the merchant or manufacturer as the daily paper or the popular magazine. There is really no business to-day that has attained any great measure of success, that does not avail itself of electric publicity in some form or other. Progressive business conditions to-day demand and must have this electric form of advertising in some form and they do have it. The electric sign, as a means of successful publicity, has made more rapid strides in public favor than any other single form of electric advertising.

The sign proposition is one that has come to stay; and its past development has been such that its future progress, as a logical sequence, will at least increase in like ratio. It is an important phase of central station business, and will become even more so as its natural development goes on. We are not likely to discard the electric lamp for the tallow dip of bygone days, and the public never goes back in essentials. The electric sign has become an essential in electric advertising, and as long as business is carried on ,advertising will be a condition of its life.

A Large New Business Department at Cincinnati.

The Union Gas & Electric Company. of Cincinnati (which is the successor of the old Cincinnati Gas & Electric Company) established last December one of the largest central-station business-getting organizations in the country. Mr. Henry L. Doherty is interested in the present company. and the methods used in the new business department are very similar to those pursued at Denver and in the American Light & Traction Company properties. The interesting thing about the Cincinnati situation is that a very large new business department was created all at once, and that this is the largest city in the United States where a new business department organized on the Denver lines has been established. The department is under the management of Mr. E. E. Miller. A number of men have been transferred from other cities where similar methods are pursued. but the majority have been secured by hiring local men who have had some experience in selling goods. The new business department numbers 66, as follows:

Division managers	4
Solicitors	44
Motor specialists	3
Sign Specialist	1
Sign draftsman	1
Illuminating engineer	1
Demonstrator	1
Saleswomen at display room	4
Clerks	4
Stenographers	2
Manager of department	1
Total	66

This force is for taking care of both gas and electric business in a city of about 350,000. It is usually considered in a case of this kind that half of the expense is chargeable to the electric department, although as a matter of fact, usually more effort is spent on the sale of gas ranges than on anything in the electrical line.

The city is divided into four divisions, each having a division manager picked from among the more successful business-getting men in other cities. Each division manager has under him the solicitors for a division, the division being divided up into blocks, each solicitor being responsible for his block. The motor specialists, sign specialists, illuminating engineer and demonstrator are, of course, not confined to any one division, but are called on as needed. It is notable that this is one of the first if not the first central-station, new-business department to set aside one man to give his entire time to illuminating engineering. It is found that there is more than enough work for a specialist of this kind in a new business department of this size.

A meeting is held every morning from 8 to 8:30 or 8:45, at which reports are heard from different men on the kind of business secured the previous day and various matters are discussed pertaining to the conduct of business and policy of the company. The four division managers take turns in presiding over these morning meetings. A meeting of the entire new-business department is held every Wednesday evening for educational purposes. It is, of course, necessary to do a great deal of educational work in creating on such short notice as large a soliciting force as that at Cincinnati.

A great deal of time of the department was spent the first few months in making a complete canvass of the city to place

in the hands of the company a record of each building and the possibilities for gas or electric service. In making this canvass a solicitor turns in a blank for each building on which is the following information: Block, number. date, name of tenant, name of owner, address, rental, value if a residence and class if a business building. Under electric equipment are the following items to be marked by the solicitor; one column being provided for alternating-current service, the other for direct-current service already in, and the third column opposite each item to be marked in case there is a prospect for that kind of service: Service, wiring, meter, fixtures, residence power, residence appliances, arcs, commercial power, size motors, fans, flat rate or meter sign outlined, flat rate or meter sign lamped, flat rate or meter window lighting, flat rate or meter building outline sign. At the bottom of the blank is a space for noting what the customer is using at present for light, cooking, fuel, water-heating, heat and power. These reports are checked over at the office to see that they are correct as to gas and electric service installed and are copied into a loose-leaf pocket-book, in which every solicitor has a record of all the buildings in his territory by streets. This book the solicitor carries with him for constant reference and is, of course, considered of first importance, being kept fully up to date.

A daily report blank is made out by each solicitor. This report has a space in which the name and address of each person called upon is filled in and under this name are 16 numbered spaces in which the solicitor can place a check mark, an X or a P. Each one of these numbers refers to a key, giving the particular business for which the call was made, to solicit or adjust. For example, Item 11 is electric window lighting. If the solicitor called on the man to solicit window lighting he puts a check mark in Space 11. If he made a sale (that is, closed a contract) he would place an X instead of a check mark in a space, and if there was a prospect of closing business, he would put a P in this space. There is also a little space to indicate the time of arriving and leaving at each call. It takes but a short time to learn the key, after which reports can be made out very rapidly. The electric items on this key are as follows: 9, electric lighting interior; 10, electric appliances; 11, window lighting; 12, signs; 13, outlining; 14, power; 15, adjustment. At the present time solicitors are paid a salary without commission, although a system of keeping records is in use whereby the solicitor is credited with a certain number of points on a system similar to that in use at Denver and described in the Electrical World of April 7, 1906. This gives a larger number of points for long-hour and non-peak business than for business requiring additional investment either in extension of lines or increase in power station capacity. This record is kept both as a healthy stimulant to the solicitors to make a good showing and to show them what the company considers the relative value of the business secured in order that they may go after the most profitable business.

NON-PEAK SIGN LIGHTING.

The company is beginning to go after sign and outline lighting on a flat rate to be turned on and off by the company and to burn from 6 p. m. to midnight between September and April and from dusk until midnight the balance of the year. This will bring the sign and outline lighting off of the winter peak load. The station has an exceedingly sharp peak in November and December which reaches its maximum about 5 p. m. and falls off enough by 6 p. m. so that considerable flat-rate sign lighting can be taken on without additional investment. The rate on this is $2.25 per 4-cp lamp per annum.

WIRING NEW BUILDINGS.

A large number of new houses are being erected this year in Cincinnati, some firms going into residence building operations by the wholesale. Of course, special attention is given to seeing that new houses are wired for electric lamps and piped for gas ranges. One firm is building 500 houses, all of which will be wired and the cost of wiring added to the selling price, the builders having been persuaded that it will be easier to sell a house that is wired with the cost of wiring added than to sell one that is not wired and on which the owner must spend considerably more than the cost of wiring during construction in order to get it wired after completion.

RATES.

A very good rate system is in force which bases its discounts on the number of hours' use per month of the connected load. This discount begins, as will be seen later, from the time the equivalent of about 60 hours' use per month of the connected load has been made. The discounts are as follows:

On a consumption per 16-cp lamp or equivalent in one month of 2000 to 3000 watt-hours, 5 per cent; 3000 to 4000 watt-hours, 10 per cent; 4000 to 5000 watt-hours, 15 per cent; and so on with a reduction of 5 per cent for each 1000 watt-hours increase per lamp, up to 15,000 watt-hours, for all over which the discount is 50 per cent, so that the consumer using his connected load 10 hours per day gets energy at 5 cents per kw-hour. On motor service the discount is in proportion to total consumption without regard to the number of hours' use of the connected load. A maintenance charge of $1 per month is made for incandescent meter service, $1 per month for each arc lamp connected and 75 cents per month for each horsepower connected; this being the minimum bill. If the bill for energy exceeds the minimum, the minimum is disregarded.

Clever Advertising at Dayton, Ohio.

Mention has frequently been made in these columns of the very energetic work being done by the Dayton (Ohio) Lighting Company in getting electric service introduced in the entire residence district of a city of 90,000 inhabitants, where, until less than two years ago, there was no electric service in the residence districts. In Fig. 1 is reproduced a photograph which was used on the reverse side of the circular which is reproduced in Fig. 2. This photograph was taken to bring forcibly before the people of Dayton the advantage of having an electric porch lamp, and is certainly a striking piece of advertising. Fig. 3 is a reproduction of a newspaper advertisement which is also very striking. This came out in the daily papers about the time spelling reform was a common topic of conversation.

FIG. 1.—BURGLAR BAFFLED BY LIGHT FROM ELECTRIC PORCH LAMP.

The Dayton Lighting Company increased its number of customers and meters 200 per cent in 1906. In 1905 the increase was 100 per cent—that being the first year the new owners took hold of the property. The increase in kw-hour output in 1906 over 1905 was 60 per cent. The increase in peak of 1906 over 1905 was, however, only 25 per cent, thus showing a most

excellent increase in the load factor and an improvement in the profitable character of the load.

The company's greatest task in the residence district has been to introduce electricity where gas has been strongly intrenched for years. The company, therefore, thought it wise to push the

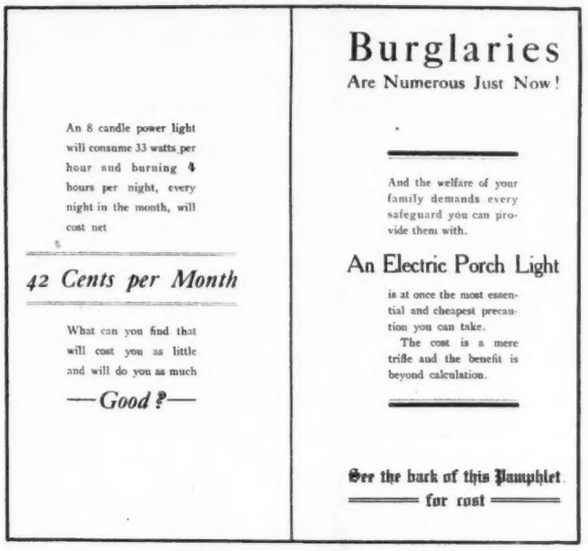

An 8 candle power light will consume 33 watts per hour and burning 4 hours per night, every night in the month, will cost net
42 Cents per Month
What can you find that will cost you as little and will do you as much
—Good?—
Burglaries
Are Numerous Just Now!
And the welfare of your family demands every safeguard you can provide them with.
An Electric Porch Light
is at once the most essential and cheapest precaution you can take.
The cost is a mere trifle and the benefit is beyond calculation.
See the back of this Pamphlet
for cost

FIG. 2.—REVERSE SIDE OF BURGLARY CIRCULAR.

turn-down lamp on account of its convenience. Girls were recently sent out with samples of these lamps to explain them to customers, and 1000 turn-down lamps were thus placed in 10 days. The lamps were placed on trial, but 99 per cent of them stayed where placed. They were sold at 50 cents each.

The Dayton Lighting Company's soliciting force consists (as it has for some time past) of nine solicitors and one clerk. The chief solicitor is the motor specialist of the force. Each of the eight other solicitors has a district allotted to him. A solicitor is paid a salary which includes his commission on a certain amount of business. If he averages less than the required amount for the year, he is not considered worth keeping. The

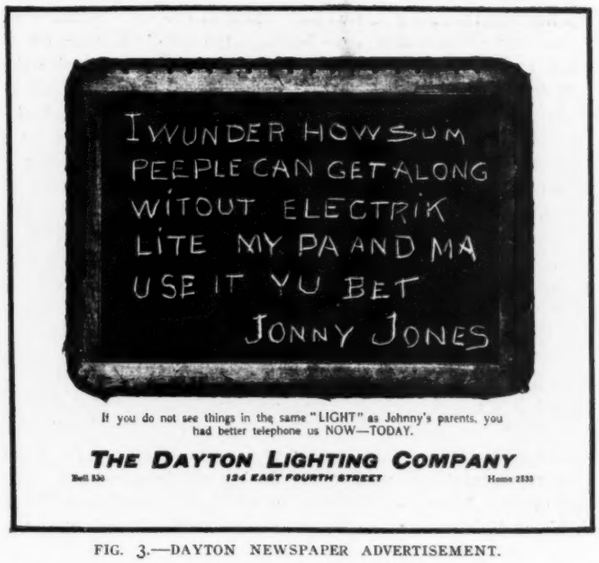

I WUNDER HOW SUM PEEPLE CAN GET ALONG WITOUT ELECTRIK LITE MY PA AND MA USE IT YU BET
JONNY JONES
If you do not see things in the same "LIGHT" as Johnny's parents, you had better telephone us NOW—TODAY.
THE DAYTON LIGHTING COMPANY
Bell 530
124 EAST FOURTH STREET
Home 2533

FIG. 3.—DAYTON NEWSPAPER ADVERTISEMENT.

solicitor is required to average 19 contracts per month, and the equivalent of a total of 550 50-watt lamps. For all above 19 contracts he is allowed a commission of 50 cents per contract, and for over 550 50-watt units he is allowed 1 cent per unit. This is on the basis of one-year contracts. If a five-year contract is secured, it is counted for three one-year contracts, and if a three-year contract is secured it is counted as two one-year contracts.

While the Dayton Lighting Company has had marvellous opportunities for growth, owing to the fact that the electric lighting business had been so little developed in Dayton up to 1905, nevertheless the rapid expansion of the business with a limited soliciting force in such a large city has only been accomplished by great enterprise and close attention to serving the public in every detail.

Newspaper Advertising.

The accompanying reproduction from the *Cleveland News* shows in reduced size one of a series of effective quarter-page newspaper advertisements of the Cleveland Electric Illuminating

What 5 Cents Worth of Electricity Will Do in Your Household
It will warm a woman's curling tongs every day in the year for three minutes and twice on Sundays.
It will warm a man's shaving water every morning for a month.
It will run a sewing machine for 21 hours.
It will brew the morning coffee in an average household for more than two weeks.
The above estimates are based on the present rates prevailing in Cleveland for consumption of current after the first hour of daily use.
Electric Light Most Desirable
for illumination in the home. The above are but few instances of what may be done in the household with electric current installed. Electric light is as economical as it is convenient. The rates are very low. The saving to decorations, etc., in freedom from smudge is considerable. Wire your house now with the long evenings ahead. The cost is very reasonable and the work is quickly, neatly done. It may be paid for in monthly payments of 10%, if desired, after an initial payment of one-fourth. Call Bell Main 2401 or Cuyahoga Central 5860.
THE ILLUMINATING COMPANY
Cuyahoga Building
Public Square and Superior Avenue

Company. The cuts catch the eye (though the curling iron is very poorly represented) and the statement as to the period of use over which a given expenditure for energy will extend is particularly effective.

Central Stations and the Manufacture of Ice.

At the recent annual meeting of the Iowa Electrical Association, Mr. Rufus E. Lee, manager of the Lee Electric Light Company, of Clarinda, Ia., presented a paper on the subject of the manufacture of ice in connection with an electric lighting and steam heating plant. After discussing the estimates given by manufacturers of ice making machinery as to the cost of making ice, Mr. Lee gave the following tabulation from the results of his experience, as the cost per ton of an independently operated ice factory producing 15 tons daily:

Two engineers	$4.50
Two tankmen	3.00
6700 lbs. coal	10.05
Oil, lights, waste, ammonia and chloride	1.25
Depreciation charges based on 3000 tons annual output	5.00
	$23.80

This makes for the manufacture of 15 tons of ice daily an average of $1.58 per ton.

As to the cost of harvesting natural ice, Mr. Lee stated that the local natural ice dealer in Clarinda claims that it cost $1.10 per ton to put ice in the house. To this must be added the shrinkage estimated at fifty per cent for all ice put in storage, so that this cost becomes $2.20 per ton. There is no doubt but that the natural ice can be put up for less than this amount in some localities, especially where the lake or pond from which ice is taken is owned by the parties putting up the ice, and the ice does not have to be hauled but run into an ice house direct from lake or pond. Mr. Lee had some experience with the delivery of natural ice last season and found that it cost fully fifty cents per ton more to deliver than artificial ice, due to distance it had to be hauled, difficulty in getting out of ice house, and trouble in cleaning. Natural ice cannot be put into a house, taken out again and delivered at the center of distribution, making proper allowance for shrinkage, for less than $1.58 per ton; and if the estimate of cost to produce artificial ice as above stated is correct, the kinds of ice are on an equality as far as first cost is concerned.

Mr. Lee then took up the matter of the advantages and savings that might be effected by combining an electric light, heat and power plant with an ice factory and the following are some of the conclusions:

1. A saving is effected by reason of boilers being operated nearer their rated capacity for an increased length of time out of each twenty-four hours, and the boiler losses remaining the same with the ice factory load on as when only the electrical plant was operated.

2. More competent engineers can be employed for both ice and electrical plant, and a small electrical plant would really not require any additional engineers. This is also true of firemen, for a fireman that can keep up steam on the peak of the electrical load can easily keep up the normal load with the ice factory added.

3. An ice plant can be shut down during the "peak load" period each evening; and the ice factory load comes at a time in the year which is just exactly opposite the winter "peak" period of electrical load and fills up the valleys on the gross return chart which in most small plants is very marked for the months of June, July, August and September.

4. There is a saving of water from the condenser, usually run to sewer but which is the best of water for boiler feed purposes, as it usually has a temperature of at least 150 degrees Fahrenheit when it comes from the steam condenser. This is a net saving of 95 degrees over the normal temperature of ordinary well water and means a saving in fuel.

5. In the spring and fall seasons, if the electrical plant is also operating a heating plant, the regular condenser used in distilling water may be dispensed with entirely, as a sufficient quantity of condensation can be secured from the return heating mains for the filling of ice cans; while this might have been used again for boiler feed purposes, yet the ice factory will furnish the heating plant with additional exhaust steam and that at a time when the heating plant is very much in need of steam, which otherwise would require live steam to maintain the pressure in the heating mains.

The Clarinda factory started to turn out ice for sale May 30, 1906, and had been in operation seven months to January 1, 1907. During this time 2800 tons of ice were made, or an average of thirteen tons per day, at a total cost of $2,958.33 or $1.05 per ton, which is a net saving of fifty-three cents per ton over the estimate for an independently operated plant. This includes a $583 depreciation charge. As there were times during the months of November and December that the plant was compelled to use some live steam for heating in addition to that furnished by electrical and ice factory load, part of the coal charged to manufacture of ice should have been charged to the heating account which would have reduced the figure of cost somewhat. As a matter of fact, during November and December the ice factory was only operated when additional exhaust was needed, so that all coal during these months might have been charged to heating.

The cost for delivery of ice to consumer and on board the cars, averaged 59 cents per ton, but as the ice shipped out of town was delivered by teamsters on board cars for 25 cents per ton, the ice sold to the small user, or 1000 tons, costs approximately $1.21 per ton. The prices received for this ice ranged from $4 to $10 per ton until October 1, when in car lots the price was reduced to $3 which was the lowest price made up to January 1, 1907. The company had intended simply to wholesale the ice, but owing to the fact that the persons who expected to retail the ice decided at the last moment not to undertake the job, it was forced to retail the ice and had been in that business only a month when it was fully convinced that it could not have done otherwise any more than a small electric light plant could undertake the manufacture of electricity and wholesale the same to a second party to retail. Coupon books were used in the sale of all ice to local consumers; no ice was sold for cash from the wagon and each driver was made to account daily for all ice taken from factory and the coupons turned in each day had to correspond with the quantity of ice taken out.

New Business Department of Combined Gas and Electric Company.

By W. H. Stuart.

Can a new business department of an electric light company, allied with a gas company, accomplish the best results possible? Can it stand forth and make a fight, backed by all that electricity stands for, without hurting the gas end? The object of the consolidation of two competitive organizations, the electric light company and the gas company, is, of course, the cutting down of expenses. No doubt in all such instances or at least the great majority of them the object has been accomplished. But, does not the decrease of expense counteract increase of business? Does not the decrease so satisfy, that the increase is not a thing to be worried over but is left rather to a spirit of "Oh, it will grow"?

What the troubles, obstacles and restrictions are of the new business departments of allied companies it is not necessary to set forth here. Suffice it to say that it is not possible for any man, no matter how aggressive and progressive he is, to do the best that is in him when his field is one with restrictions. One finds a great difference between the simple instruction of "Get business" and "Get business but don't interfere with the gas end."

An instance worth citing here is one which covers well the situation. A short time ago a motor solicitor employed by a corporation which owned the gas and electric interests got a line on a manufacturer who needed energy of some 50 hp or more. The solicitor called several times and talked about the cost of the motor, the cost of operation, the ease with which it could be started and shut down, the floor space the motor would occupy, how it could run as well placed on the ceiling, on the side walls as the floor and other distinct advantages. Upon his next call he learned that the gas engine man had become "wise" and had called and set forth the advantages and qualities of the gas engine. The prospective consumer felt that he was left on a fence. He was presented with the choice of accepting one of two entirely different power propositions, each one without a flaw, and in so far as he learned from the two representatives, neither one had a single advantage over the other. After considering the question some time without further aid from the power solicitors, he finally came to the conclusion of weighing numerically the advantages claimed for the electric motor and those claimed for the gas engine. Upon summing up the two he found that the score stood 8 to 1 in favor of the electric motor. He then decided that of the two he would accept the motor proposition; but the matter hung fire for some time and finally one day he received and accepted a proposition from another manufacturer to build another story to his present building, install a boiler and a steam engine, connect up a small dynamo for lighting purposes and

go ahead on the basis of one man running ten hours during the day and the other twelve hours during the night, making a continuous run of twenty-two hours. This plant is still in operation in a supposedly up-to-date progressive electric lighting company's territory, and there are similar cases occuring along just such lines elsewhere. The fault lay in that the electric solicitor was cautioned against the use of arguments against a gas engine proposition.

Another instance bearing somewhat upon the present subject was that of a stretch of three blocks of the finest residential property in a city of considerable size. This had been owned by a lawyer who was averse to granting corporations an inch under the impression that they would soon obtain the proverbial yard. When he sold his property in parcels he placed certain restrictions upon it, among these being against pole lines either on the street or in back yards, and one against overhead connections. As the large handsome residences were being built they were also wired and equipped for electric light and the owners made application for service, suggesting the construction of a conduit through their back yards. The company's answer was that under no consideration whatever would it run a conduit because to do so would furnish a precedent; yet in the next six months the same company in another part of the city was laying all its wires underground, forced by a city ordinance of which the company was well aware of when it refused to establish a precedent. The progressive property owners then turned their longing eyes to the gas end of the same corporation and were finally accepted as good and faithful followers.

Gas is used and will be continued in use in hundreds of places in the city where the household use of electric energy is considered a fad of the rich. Viewing the matter from the company's standpoint, the securing of every new consumer of electric energy means that it will keep just so much abreast of the times. Electricity is now becoming the illuminant and power factor of the age and gas is slowly but surely being pushed back with the kerosene lamps and the candles. Where do you suppose a company not permitting and inspiring the new business department to do everything possible to bring the greatest results, will find itself in a few years to come?

Unless a corporation has been extremely open and fair and liberal in its dealing with the public, always making the first advances in the interests of the consumers, going out of its way to offer help and advice and taking the public into its confidence, it will find that there will be placed quite a heavy burden upon the new business department. I know of cases of business men using gas and electric light disputing the amount of an electric light bill, and upon being informed as to its correctness and justness, would make all kinds of accusations against the integrity, moral character, and business methods of the corporation, his thought being that they have him both ways, and that he has either to pay that bill or do without both gas and electricity.

LETTER TO THE EDITORS.

The Central Station and the Electric Vehicle.

To the Editors of the Electrical World:

SIRS—I have read with much interest your article in the first issue of April on "The Central Station and the Electric Vehicle," and quite agree with your editorial remarks as to the desirability of the encouragement by the central station of the electric vehicle as a source of off peak load. It is, in fact, surprising that apparently so little attention has been given by central station managers to this subject, particularly in the way of initiative. All except the smaller central stations could utilize to good advantage such a means of light transportation, and it would be a good business policy for an electric lighting company to encourage one or more of its officers to secure such vehicles for personal use by according liberal terms for charging. In either case the provision of plant for the service and the knowledge of details of charging and care that would be acquired would furnish a constant incentive to the management of the station to interest the public in the electric vehicle. It is not too much to say that if the central stations had given intelligent encouragement to this branch of the electrical industry eight or ten years ago, the latter would be in a vastly more prosperous condition than at present and the charging load would have become a very considerable source of station income. In the case of the gasoline vehicle the owner can purchase his power where he will, but in the case of the electric rival he is dependent upon the local electric company. If this does not offer proper facilities for charging or care, or shows only half-hearted interest in the electric vehicle, the gasoline automobile will win out every time. Owing to its franchise, the central station is not spurred to enterprise by electrical competition; as a consequence too frequently it overlooks opportunities for extension of business, and the past neglect of the electric vehicle appears to be an illustration of this condition.

CHICAGO, ILL. JAMES L. BERTRAM.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Induction Motor.—L. J. HUNT.—The conclusion of his illustrated paper on a new type of induction motor. The novel feature lies in the stator, which is parallel wound and cross connected at certain equi-potential points. The rotor carries two windings, each for a different number of poles, and is so connected that the current from the principal winding traverses the second winding, and produces a superimposed magnetic field, which in turn induces secondary currents in the closed portion of the stator windings. The machine is really a form of "cascade" motor, having two rotor windings and two stator windings, combined in one stator and one rotor. In an editorial note on this paper it is pointed out that Steinmetz, Goerges, Meller and S. P. Thompson have worked upon this problem and that Hunt's latest attempt closely follows the lines taken by the previous experimenters. In the corresponding design of continuous-current motors, the problem is to find a method whereby the back e. m. f. of the armature may be maintained at a practically constant value for any and all of the speeds at which the motor is to run. In the case of induction motors the problem is much the same, only with the additional requirement that the frequency of the back e. m. f. of the stator winding must also be maintained at practically a constant value. The ordinary cascade system of control may be considered as a device whereby the frequency of the supply-current is divided between two or more motors—Lond. *Elec. Eng'ing*, April 4

Circulating Currents in Three-Phase Generators.—A. G. GRIER.—A discussion of the different higher harmonics which may occur in three-phase generator windings, with the reproduction of various curves taken by the oscillograph—*Electric Jour.*, April.

Air-Gap M. M. F.—L. LEGROS.—The conclusion of his mathematical article on the predetermination of the ampere-turns for the air-gap of electric machines. The author gives various formulas, the last ones of which he has found to be quite exact. —*L'Eclairage Elec.*, April 6.

Lamps and Lighting.

Effect of High-Efficiency Lamps on the Industry.—TATLOW.—A paper read before the Dublin section of the (British) Institution of Electrical Engineers. After briefly mentioning the different types of high-efficiency metallic-filament lamps which are now on the market he discusses the effect which their introduction into practice may have on the electric lighting industry in England. (It should be understood that in England many

stations during the last eight or ten years have doubled the supply voltage in order to increase the area which can be supplied efficiently from one station.) When a new system of lighting is being designed, it is necessary to consider whether it will not be worth while to lay it out at a lower voltage instead of at the 200 or 220 volts which has been so much used of late, in order to take advantage of the great economy of the metallic-filament lamp. In spite of the fact that these lamps take much less current than the corresponding carbon-filament lamps, it will still be necessary to considerably increase the section of main cables in order to have the same percentage drop as in the case of 220-volt carbon lamps, but this and the larger initial cost of lamps are the only items of capital expenditure against the use of metallic-filament lamps and low pressures to suit them. On the other hand, there is a somewhat reduced cost of engines and dynamos. There is also a considerable reduction in the cost of the storage battery for equal lamp hours, amounting to at least 35 per cent. With respect to annual cost of operation there will be a considerable saving in fuel and in the cost of maintaining the battery owing to its reduced size; against this must be placed a greater annual cost for lamp renewals, but the new lamps have a considerably longer useful life than high-voltage carbon lamps which helps to counterbalance their higher cost. In the case of a direct-current 220-volt supply network, the new lamps must be run in series, which is, as a rule, inconvenient except for street lighting. When one comes to the case of alternating currents, the great facility for changing the pressure of these currents by static transformers can be utilized. In order to make an existing installation fed from 200-volt alternating-current mains suitable for the use of these new lamps, all that is required is to divide the sub-mains feeding the distribution boxes into two groups as nearly balanced as possible, and to feed these from a balancing coil or auto-transformer in the manner in which a pair of 100-volt arc lamps would be run on the same circuit. The author has experimented with an ordinary arc-lamp balancing coil having a no-load loss of 60 watts, which can deal with an out-of-balance load of 14 amperes at 100 volts, equivalent to about 40 lamps; the loss in the coil when working under the latter conditions increases to about 75 watts. By making use of modern special qualities of iron, such as "stalloy," the no-load loss, or loss when balance is approximately obtained, could probably be got down to less than 30 watts, and it would certainly pay to use the best available iron when the lost energy is being purchased at lighting rate. If it is assumed that the out-of-balance load would never exceed one-third of the maximum load, such a transformer would be capable of balancing an installation using in all 42 amperes at 100 volts at maximum load; in other words, 4200 watts would be made available for lighting at the lower pressure with an average loss of, say, 40 or 50 watts in a specially designed balancing transformer while working. The adoption of metallic filament lamps in such an installation as the above should result in a saving of at least 33 per cent of the power used, while providing at the same time a considerable increase in the light. This saving would be some 1400 watts at full load, from which must, however, be deducted, say, 50 watts used in the transformer. The use of an ordinary transformer instead of the above arrangement would be more expensive, and the operation less satisfactory. If the new lamps are introduced largely in practice the bills of many large consumers will be ultimately reduced, but the number of consumers will be greatly increased. The change will involve dealing with a larger number of consumers and collecting a larger number of accounts from a given sale of kw-hours. On the other hand, the load factor will probably improve slightly. The following figures are given concerning the specific consumption of several of the new lamps: The number of watts per cp is 1.7 for the 24-cp 110-volt tantalum lamp; 2.2 for the 14.5-cp 110-volt tantalum lamp; 1.4 for the 25- to 32-cp 100-volt osram lamp and 1.037 for the 48-cp 37-volt zirconium lamp. In the discussion some speakers thought that low-cp lamps were essential for private house lighting. The chairman, T. Tomlinson, considered that the action of the supply authorities in doubling the pressure of supply was entirely wrong, and believed that it is due solely to that action that the efficiency of lamps is so low to-day. Had the pressure been maintained at 100 volts or thereabouts, lamp-makers would have made a very much better lamp.—Lond. *Elec. Eng'ing*, April 4.

Standardization of Arc Lamps.—The photometric committee of the Association of German Electrical Engineers and the sub-committee for arc lamp standardization of the Association of German Electricity Works have revised their standardization rules which will now be voted on at the next annual meetings. According to the new rules an arc lamp is practically rated according to its most important application, namely, the direct illumination of the space below the horizontal plane through the source of light. The practical unit is, therefore, the mean lower hemispherical candle-power (notation J ⊍) measured in hefner candles (notation H. K. ⊍); thereafter is to be placed in parenthesis that coefficient by which the mean lower hemispherical candle-power is to be multiplied in order to get the mean spherical candle-power ($k_0 = \ldots$). The figures thus given are taken from the measurements on arc lamps as used in practice, but without external reflector and tested with plain, not frosted, glass globes, which are substituted for the regular globes used with the arc lamps in practice (or for both the internal and external globes in the case of enclosed arcs). For alternating-current lamps a sinusoidal wave form of the e. m. f. and a frequency of 50 periods are assumed. The practical power consumption (*praktischer Effekiverbrauch*) of an arc lamp is the total consumption of an arc-lamp circuit measured at the points where the circuit is fed from the net work, divided by the number of lamps. In giving this figure the voltage of the net work is also to be given. The figure thus defined, divided by the mean lower hemispherical candle-power is called the practical specific power consumption (*praktischer specifischer Effektverbrauch*) and the notation is "W/HK ⊍ at *n* volts network-tension." For alternating-current lamps it is to be stated in every case whether non-inductive or inductive series resistances are used. The value of H K ⊍ /W at *n* volts network-tension is called the practical light output *(praktische Lichtausbeute)*. Brief rules are also given how to conduct the photometric tests of arc lamps. The determination of the mean lower hemispherical candle-power is carried out either by determining the mean polar curve, which requires a number of measurements, or by a single measurement with the aid of the Ulbricht sphere with a diameter of at least 1.5 meters.—*Elek. Zeit.*, March 28.

Measurement of Mean Horizontal Candle-power.—Hyde and Cady.—A discussion of the possible sources of error of the rotating-lamp method for determining the mean horizontal candle-power of incandescent lamps. The two possible sources of error are the possible distortion of the filament and the effect of the flicker which is perceptible in nearly all types of lamps when rotating at 180 r. p. m. and which is specially bad in those types in which the horizontal distribution curve deviates greatly from a circle. The effect of the bending of the filament was studied at various speeds up to 600 r. p. m. At such high speeds very appreciable changes in the mean horizontal cp, due to bending, were observed. The greatest change in mean horizontal intensity due to the bending of the filament occurred in the double carbon type of filament in which, on the average, a decrease of 0.9 per cent was observed. The greatest increase was 0.8 per cent, which was the mean value found for the downward light type of filament. At a speed of 180 r. p. m. the change in mean horizontal intensity due to bending was so small for all types of lamps studied as to light within the range of experimental error which was probably several tenths of 1 per cent. (A queer effect was observed with the tantalum lamp, namely, an apparent increase of resistance on rotating it. At least a half-dozen lamps were tested, each of them several times, and without exception on rotating lamps the current decreased, although the voltage was maintained constant. The amount of change was not the same for all lamps, nor, indeed, the same at different times for any

one lamp, but ranged from 1 per cent to only a few tenths of 1 per cent.) The effect of flicker in lamps which show it in a disagreeable degree was found to be very peculiar. With different observers the effect of the flicker was quite different. Thus, while one read the flickering light about 4 per cent too high, the other read about 3 per cent too low—a difference of 7 per cent. Moreover, each observer persisted in his habit, so that when, about this time, a number of lamps submitted for test were measured, it was subsequently found on looking over the results that while the values obtained by the two observers agreed excellently for most lamps, there were large differences, always in the same direction, for lamps in which there was a disagreeable flicker. Such differences were found also with other skilled experimenters. The effect is explained that the eye does not integrate a flickering light. From the investigation it is evident that in the case of lamps in which the horizontal distribution curve deviates considerably from a circle so that a bad flicker results when the lamp is rotated at 180 r. p. m., some modification for determining the mean horizontal intensity must be employed. Otherwise, large errors amounting to many per cent may arise. It is impossible to state what the errors may be because they depend entirely upon the individual. The remedy is as follows: If to the illumination produced by the direct light from the lamp on the photometer screen, an illumination produced by light emitted in a direction normal to the photometric axis be added, the resultant illumination will show a relatively small variation on turning the lamp. If the lamp is rotated at the customary rate of 180 r. p. m. the flicker will be much less disagreeable and productive of error than that incident to the direct light alone when the lamp is rotated at double this speed. This result may be easily obtained in practice by means of a single stationary mirror and this remedy was, indeed, found to be very effective.—*Bull. Bureau of Standards,* Vol. II, No. 3.

Metallic Filament Lamp.—A brief note on a recent English patent of Bloxam (Lux), disclosing a plan for causing metallic filaments to assume a curved form with the object of neutralizing the effects of mutual attraction. The filaments are "curved in relation to the wall of the enclosing bulb." The curvature is obtained by subjecting the filaments to the action of magnetism, frictional electricity, centrifugal force or heat either before or after the fixing of the filament in the bulb.—Lond. *Elec. Eng'ing,* March 28.

Enclosed Arc Lamps.—W. WEDDING.—A review of the present condition of enclosed arc lamps. Compared with the United States, in Germany the enclosed arc lamp has made little headway in the past, but the situation is now changing and the author discusses the great suitability of enclosed arcs for the lighting of railway stations and for use in factories where there is danger of fire or explosions.—*Elek. Kraftb. u. Bahnen,* March 14.

Singing Arc.—H. T. SIMON.—An article illustrated by diagrams on the theory of the singing arc. The mathematical theory is given and explained with the aid of oscillograms.—*Elek. Zeit.,* March 28.

Power.

Smoke Prevention.—J. B. C. KERSHAW.—A paper on smoke prevention in factories and electric supply stations. In the case of bituminous fuel over 20 per cent of the volatile hydrocarbon gases are liberated. Three conditions are essential for the perfect combustion of this mass of combustible vapors—namely, an adequate supply of air, an adequate degree of temperature, and an adequate admixture of the gases with the air supplied to the furnace. A combustion chamber is required in which the heated gases can burn completely before coming into contact with the water-cooled plates or tubes of the boiler and also, some arrangement for causing thorough admixture of the heated gas and air. The combustion chamber must be lined with refractory material, and be maintained at a temperature of 1000 deg. C., and its size ought to be proportioned to the volatile matter contents of the fuel to be consumed. In a boiler furnace constructed in accordance with these recommendations, it would be possible, with the aid of a good stoker, to burn the cheapest class of bituminous coal without smoke production. These principles are very old, but have been neglected for a long time.—Lond. *Elec. Eng'ing,* April 4.

Winding Plant.—A fully illustrated description of the electric winding plant at the Grangesberg Iron Mine, in Sweden. The power station is placed at a waterfall about 18 miles away, and three-phase current is transmitted to the mine at 8500 volts pressure by an overhead line. The high-tension current is transformed down to 430 volts at the mine sub-station. A synchronous motor coupled to a direct-current generator is installed to provide continuous-current supply for the winding engine. The capacity of this set is about 400 horse-power. A motor-generator is employed instead of a rotary converter, as the comparatively high periodicity of 70 is used. Moreover, the over-excited synchronous motor improves the power factor somewhat. This motor-generator runs continuously, charging a battery of 243 Tudor cells, having a capacity of 600 ampere-hours at a very high discharge rate. The battery operates in parallel with the motor-generator when winding is in progress, there being a few series turns on the field-magnet coils of the latter, through which the battery current passes when discharging, acting in opposition to the shunt winding and thus lowering the voltage of the generator somewhat, and allowing the battery to do its share of the work during times of heavy demands for power. The winding drums are of the tapering spiral type, to compensate for the weight of the ropes and to facilitate acceleration. There is a motor at the outer end of each winding drum, the armatures being mounted direct upon the drum shafts with no outer bearing. Each motor is a 16-pole machine, designed for an output of 500 horse-power at a speed of 38 r. p. m. The field magnets are compound wound, the ratio of shunt ampere-turns to series ampere-turns being 3 to 2 at normal full load and 9 to 11 at starting. The current density in the armature conductors is extremely high, reaching the figure of 10,000 amperes per square inch of section at starting. At the present time, now that winding is done from a comparatively shallow shaft, the two machines are coupled in series giving a speed of only 19 r. p. m. They will be coupled in parallel and the speed doubled when the shaft is deepened. The controlling apparatus is extremely simple to manipulate by means of one lever. The rheostat for inserting a cutting-out resistance in the armature circuits consists of a large commutator. This commutator is mounted with the segments vertically in a fixed position; an arm carrying carbon brushes mounted on a vertical axis is moved round the commutator by means of a rack and pinion, and in rotating cuts out the resistance gradually, segment by segment. The resistance consists of cast-iron V-shaped strips bolted between the commutator arms, and easily removable should a burn out occur. The rack, which gears with the pinion keyed on the movable brush arm, is operated by air pressure.—Lond. *Elec. Eng'ing,* April 4.

Electric Pumping.—W. C. MOUNTAIN.—An abstract of a paper read before the North East Coast Institution of Engineers and Shipbuilders on the application of electricity to the driving of pumping machinery for pontoon and graving docks. He would not recommend putting down an electric generating plant for driving the pumping machinery on a single or even on two docks. But where dock owners possess a number of docks there is no doubt that one central station that can supply electricity to the whole of them would be found very much more economical than independent steam pumping stations with a staff of men at each dock. Numerous figures are given on details of dock pumping, both for steam and electric operation, and on electric installations in numerous English flooding docks. The principal data as regards dimensions, pumping machinery and the cost of pumping per ton docked are given.—Lond. *Elec.,* March 29.

Geneva.—The municipality of Geneva has arranged a prize competition for the utilization of water power of the Rhone River near La Plaine. The new power station will be operated in connection with the power station of Chevres. For this reason two-phase generators at 5000 volts and 48 periods must be

used. At the side of each machine set a switchboard is to be installed by means of which the dynamos may be connected either directly to a 5000-volt network or, with the interposition of transformers, to a network of 20,000 or 25,000 volts.—*Elek. Zeit.*, April 4.

Water Power in Queensland.—An abstract of a report by W. Corin on the utilization of water powers in Australia. In this case the Barron Falls, in Queensland, have been under consideration. The power available without storage is about 3500 horse-power for 24-hour supply, but with storage in the higher reaches of the river this amount might easily be doubled or tripled. It is proposed to transmit the energy to Cairns, a distance of about 12 miles and utilize it there for lighting purposes, railway operation, driving sugar mills and electrometallurgical manufactures.—Lond. *Elec. Eng'ing*, April 4.

Turbo-Dynamo.—An account of a test made recently on a 750-kw Parsons-Brown-Boveri turbo-generator. The steam consumption per kw-hour at full load was 17.5 lbs. (as against 18.3 lbs. specified), and at half-load was 19.2 (as against 24.2 specified). Steam at 113.25 lbs. pressure and at a temperature of 300 deg. C. was used. The vacuum in the condenser was between 90 and 93.5 per cent. The steam consumption was determined by the weight of water condensed. When the full-load was suddenly taken off, the momentary speed-variation was 5.5 per cent and the permanent alteration 2.5 per cent. When the full load was suddenly put on, the speed variations were respectively 3.7 and 0.8 per cent. The voltage variation, without any alteration of the excitation, was 11.6 per cent when the load was removed and 8.5 per cent when it was put on. The set gave an output of 952 kilowatts for half an hour without difficulty. The actual steam consumption was less than that guaranteed by about 14 per cent at full load and 24 per cent at half load.—From *Zeit. f. d. ges. Turbinenwesen*, abstracted in Lond. *Elec.*, March 29.

Traction.

Single-Phase Traction in Berlin.—W. Reichel.—An abstract of a paper in which the author said that the Stadt und Ringbahn in Berlin can no longer meet the demands of the traffic. It is now proposed to introduce electric operation and employ the single-phase system. The electric trains, composed of motor cars and trailers, will have a capacity of 602 passengers, against 475 with the present steam-operated trains. The trains would follow each other in intervals of 100 seconds. These intervals could be decreased to 90 seconds, or 1½ minutes, after improving the signal system. In this way the capacity of the plant would be increased 120 per cent compared with the present steam operation and 80 per cent compared with a possible improved steam equipment. A voltage of 10,000 is proposed for the trolley wire, while the electricity will be transmitted at 40,000 volts from two power stations, each of 30,000 kilowatts. —*Elek. Zeit.*, April 4.

Liverpool.—An abstract of the annual report of the municipal tramways of Liverpool for 1906. The plough life guard with which the cars are fitted, has pushed 44 people who had fallen in front of the cars, or had been knocked down, clear of the rails without serious injuries. Of the four fatal accidents which occurred on the system during the year, three were caused by persons attempting to leave cars in motion, and the ratio of fatalities to passengers carried has decreased from 1 in 6,000,000 in 1887 to 1 in 30,523,632 during 1906. The number of passengers carried in 1906 was 122,094,528, and the car miles were 12,115,934. The total expenses per car mile, including capital charges, were 19.844 cents, the corresponding earnings 22.34 cents. The average fare per passenger was 2.16 cents and the average length of a penny (2 cents) stage was 2 miles 699 yards.—Lond. *Elec. Eng'ing*, April 4.

Installations, Systems and Appliances.

Small Municipal Plants in England.—An anonymous article by the "resident engineer of a small municipal electricity works." The recent decision of the Whitehaven and Bath Corporations and the Bray Urban Council to dispose of their respective undertakings to companies, cannot but be regarded with significance, and it would appear probable that in the near future other undertakings may adopt a similar course. One has only to glance at the published records of some of the smaller undertakings to see that many of them are not, and can never be, a financial success. The writer believes that in order that a municipal undertaking shall be self-supporting a gross profit of not less than 10 per cent on the capital expenditure must be made. In the case of the smaller undertakings one of the chief causes of financial failure is due to the excessive capital expenditures per kilowatt of useful plant installed and the generally lavish manner in which these undertakings were equipped. The disadvantages of municipal undertakings are the methods used in the selection of the staff, the red tape which is employed everywhere, etc.—Lond. *Elec. Eng'ing*, April 4.

Paris.—With reference to the question of the future electricity supply in Paris, an account is given of the negotiations between the Paris Municipal Council and the Parisian Company de Distribution d' Electricité with regard to the renewal of the franchise. The agreement has been practically concluded and the company receives a franchise for the supply of electrical energy in Paris until the end of 1940 under certain terms, which include certain fixed maximum prices, and compulsion to spend a certain sum annually on extensions. An eight-hour day has not been granted to the workmen, but they are to be placed generally on the same basis as men in the municipal service and the company has to contribute largely to their pension fund. The rates which have been accepted are 14 cents per kw-hour for lamps and 6 cents for motors to the end of 1913. Beginning with that date up to 1940 the price is to be 10 cents for lamps and 6 cents for motors. These prices are the maximum allowed and where the present prices are lower they are not to be raised.—Lond. *Elec. Eng'ing*, March 28. A long report of the discussions before the Paris Municipal Council concerning the future electricity supply is given in *L'Industrie Elec.*, March 25.

London.—R. L. Pearson.—In a continuation of his illustrated serial on electric energy supply in London, the system of the West Ham Corporation is dealt with. High-tension in single-phase current is used at 2000 volts, the frequency being 50 per second, and the pressure at consumers' terminals 100 and 200 volts. The generating machinery at the power station consists of eight reciprocating steam engines and one steam turbine, having a total normal rating of 6900 kw and an overload capacity of, on an average, 20 per cent. Quite recently a two-phase supply has been started for motor purposes in a certain area. Direct current is used for traction motors and arc lamps. Practically the whole of the arc lighting equipment has been remodelled during the past two years, groups of alternating-current lamps being replaced by groups of direct-current lamps run from the 500-volt mains. West Ham was probably the first undertaking in England to run bare overhead conductors on the back of the tramway columns for feeding series of of 10 lamps at 500-volt direct current. There are also three long series of lamps worked from Ferranti's rectifiers. The growth of the power load is indicated by the fact that 1200 hp have been added since April, 1906.—Lond. *Elec.*, March 22, 29. —In a further continuation of the serial the London County Council electric supply bill is discussed.—Lond. *Elec.* April 5.

Rathenow.—H. Wille.—An illustrated description of the new municipal central station of Rathenow, a city of 24,000 inhabitants in Germany. The power house is equipped with gas engines and the three-wire system of 2-by-220 volts is used. The energy is used mainly for lamp and motor purposes in the large optical industry in that city.—*Elek. Kraftb. u. Bahnen*, Feb. 14.

Diesel-Engine Station.—M. Mulertt.—An illustrated English translation in abstract of his recent German article on the Diesel-engine central station of Friedenau, near Berlin.—Lond. *Elec. Eng'ing*, March 28.

Motor-Generator in Traction Plant.—A note on a new type of motor-generator in use at the power station of the Hamburg suburban railway Blankenese-Ohlsdorf. This station is de-

signed to supply single-phase alternating current at 25 periods for traction work, single-phase alternating current at 50 periods for lighting purposes and direct current for exciting the alternators and driving the auxiliary machinery. In order to obtain the most economical working the three separate networks are coupled up by means of a special motor-generator set which boosts up the e. m. f. on any two networks by means of the excess power on the third. This set consists of three machines coupled together, a direct-current machine, and two alternating-current machines, the latter supplying current respectively at 25 and 50 periods. Any one of the machines drives the other two as generators when required.—Lond. *Elec.*, March 29.

Central Station Supply Economics.—The conclusion of the long illustrated report of the extended discussion which followed A. M. Taylor's recent paper on this subject.—Lond. *Elec.*, March 29.

Remote-Control Switchboard.—F. WALKER.—A paper read before the Glasgow section of the (British) Institution of Electrical Engineers giving details with full illustrations of the switch gear of the Greenwich power station, where remote control is used to a large extent.—Lond. *Elec.*, March 29.

Wires, Wiring and Conduits.

Drop in Alternating-Current Circuits.—C. F. SCOTT AND C. P. FOWLER.—An article with reference to Mershon's method of finding the voltage drop in an alternating-current circuit. The authors describe a modification of this method which involves only nine steps, as compared with the 12 steps in Mershon's method. The drop or "resistance volts" are first determined which would result if a direct current would flow through the circuit. A "drop factor" is then found by which the direct-current drop is to be multiplied in order to obtain the alternating-current drop. The drop factor depends upon three things—first, the ratio between the reactance volts and the resistance volts; second, the power factor of the load, and third, the percentage value of the resistance volts. The third element is in general insignificant, and the method of the authors to determine the drop factor is first to read from a table given in the article the ratio of reactance volts to resistance volts as function of the size of wire, the distance between the wires and the frequency. A second table then gives the drop factor as the function of the power factor and the ratio of resistance volts to reactance volts. Numerical applications of the tables are given.—*Electrical Journal*, April.

Indicator of Pressure in a Line.—A description of a device by A. C. Cossor for indicating at any time whether a high-tension conductor is live or not. It is a vacuum-tube detector and is illustrated in Fig. 1. The complete vacuum-tube high-

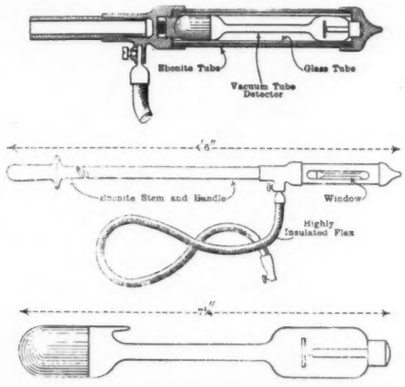


FIG. 1.—LINE PRESSURE INDICATOR.

tension detector rod is shown in section in the diagram at the top, while the next diagram below gives a general view. The detector itself consists of a glass tube about 6 ins. long of the form shown in the lowest diagram, and with one internal and one external electrode, the latter being in the form of a tinfoil coating to the glass. The tube is exhausted so as to glow with a maximum brilliancy, and will light up brightly on any voltage from 1200 to 20,000 volts. The detector tube is encased in a stout external protecting glass tube, and this is again enclosed in an ebonite tube having a window for viewing the detector. One end of the detector tube is connected to a pointed metal cap, and the other through a spring to a metal fitting. This fitting screws on to the stem and handle, and to it is attached a length of special highly-insulated flexible cable, the insulation of which is capable of withstanding an alternating e. m. f. of 13,000 volts for 15 minutes. This flexible connection is intended to be joined to any convenient earth, and the pointed end is touched to the conductor to be tested.—Lond. *Elec. Eng'ing*, March 21.

Pressure Rise on Transmission Lines.—E. HUDSON.—A paper read before the Dick-Kerr Engineering Society discussing the causes of pressure rise on high-tension transmission lines, namely, lightning discharges; switching operations; resonance; short circuits in open spaces. The fundamental formulas are given for the different cases.—Lond. *Elec. Eng'ing*, March 22.

Underground Mains.—W. M. ROGERSON.—A paper read before the Leeds Section of the (British) Institution of Electrical Engineers dealing with many practical points in connection with mains laying and distributing networks. There was also an extended discussion on various details.—Lond. *Elec. Eng'ing*, March 28.

Electrophysics and Magnetism.

General Problem on Electrical Engineering.—M. LATOUR.—With reference to the recent article of H. Poincaré, the author refers to certain problems of electrical engineering which are inherently impossible of solution. Their absurdity has mostly been recognized by experimental failures rather than theory. One of these impossible problems is the self-excitation of a system of alternating currents without the use of condensers or commutators. The author has referred to this in a former note. In the course of a discussion M. LeBlanc has pronounced the following problem, "Let a system of electric circuits be given which contains no capacities and in which nothing revolves. Whatever may be the mutual inductances the self-inductance and the resistances, if a source of alternating e. m. f. is connected to one of the circuits the current always lags in time phase behind the e. m. f." While this statment will now be accepted by engineers, its theoretical reason is not so clear and the absurdity of the conception of a leading current due to complex mutual inductances and resistances is not recognized at once. The author proved the correctness of the statement mathematically.—*L'Eclairage Elec.*, April 6.

Units, Measurements and Instruments.

Alternating-Current Galvanometer.—H. ARMAGNAT.—Direct-current galvanometers are based on the action between a magnet and the current to be measured. If the same principle is to be applied to an alternating-current galvanometer, an alter-

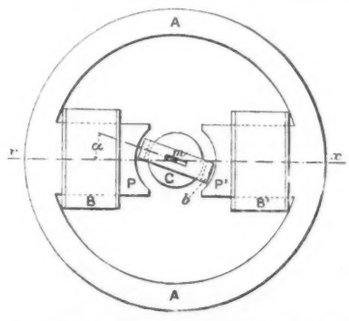


FIG. 2.—ALTERNATING CURRENT GALVANOMETER.

nating-current electromagnet must be used of the same frequency as the current which is to be measured. Two different instruments of this type have recently been devised. One is due to Franklin and Freudenberger (see Digest Jan. 19, page 150). The second was devised by M. Abraham. It is a moving-coil galvanometer in which the alternating flux is provided by an electromagnet with laminated core and excited by an

alternating current of the same frequency as the current under test. The electromagnet has two coils *B B'* (Fig. 2) wound around the cores *P P'*. The ring *A* connects the two cores The moving coil *b* is in its normal condition parallel to the axle *xx'*. If the coils *B B'* carry an alternating current of constant effective value, an alternating current *i* of the same frequency passing through the coil *b* will produce a deflection by an angle which is proportional to *i* and the cosine of the phase difference between *i* and the current which produces the magnetic flux. To compensate the electromagnetic torque Abraham uses in series with the coil *b* a resistor having a resistance *R* shunted by a condenser of capacity *C* as shown in

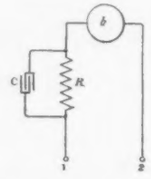


FIG. 3.—ALTERNATING CURRENT GALVANOMETER.

Fig. 3. This arrangement is equivalent to a negative self-induction, practically equal to $C R^2$ and by varying *C* and *R* it is easy to compensate for the electromagnetic torque.—*L'Ind. Elec.*, March 10.

Instruments.—H. Armagnat.—An illustrated review of various new instruments exhibited at a recent exposition of the French Physical Society. Among them are the Abraham-Carpentier rheograph for demonstrating in the lecture room the wave form of alternating currents; a new wattmeter of precision by Chauvin and Arnoux; several meters, galvanometers and recording instruments; also numerous electrical instruments for medical purposes.—*La Revue Elec.*, March 30.

Oscillograph.—A note on a paper by Kohlrausch read before the Hanover Electrical Society on the oscillograph of the Siemens & Halske Company, which is of the Blondel type.—*Elek. Zeit.*, April 4.

Iron Tests.—P. R. Fortin.—A description in detail of the equipment and routine of a works laboratory devoted to electric and magnetic iron for commercial purposes.—Lond. *Elec. Eng.*, March 22.

Telegraphy, Telephony and Signals.

Undamped Oscillations.—M. Reithoffer.—An article in which the author gives a physical explanation of the Poulsen method of producing undamped oscillations. He disagrees with other theorists who have stated Poulsen's oscillation to be a forced one.—*Elek. Zeit.*, April 4.

H. T. Simon.—In an appendix to the conclusion of his article on the theory of the singing arc, the author claims that Poulsen's method is in principle identical with that patented by the present author and Reich. The typical feature is a dissymmetry of the employed arc.—*Elek. Zeit.*, April 4.

BOOK REVIEWS.

The Steel Square as a Calculating Machine. By Albert Fair. New York: The Industrial Publication Company. 81 pages, illustrated. Price, 50 cents.

The author does not claim that this is an original book, but says that the matter is put into more simple form than can be found elsewhere, as it was written for the benefit of the ordinary workman without a technical education. Perusal of the work justifies the claim. Those who have not previously given the matter due attention will be surprised to note the many and varied problems that can be solved by this simple tool. A periodical publication seems to be a more suitable medium for criticizing the statements of others than a book, as in the former case the criticized parties have an opportunity to reply; but the author of this book thinks otherwise and has acted accordingly, being careful to add in his criticisms that the mistakes noted are not printers' errors. However, the plan adopted may prove beneficial to others who have failed to discover the blunders mentioned.

Quasi-Public Corporation Accounting And Management. By John F. J. Mulhall, P. A. Boston: Corporation Publishing Co. 204 pages.

This book starts off with forms of stocks and bonds, together with sample rulings of the proper books in which to record these securities. Much space is given to the various forms devised for use in connection with various objects, including water works, gas works, electric light works, steam heating works, telephone companies and electric railways, and ending with a short article on audits and examination, and tables of depreciation, and annuity, compound interest, and sinking fund tables. These latter are particularly valuable, as they appear in very few such works.

Like all such books, the forms shown are entirely typical and are probably taken from those in use at some one works, where they have been devised for the particular requirements of the officials in charge. One having anything to do with the organization of such work almost always finds the officials at the head seldom agree as to the best forms for use in connection with the work, as each manager has his own ideas regarding the information he personally desires and therefore, beyond indicating the line which such forms should take, it is practically impossible to make one set of forms which will satisfy any two managers.

A large part of the work is devoted to forms for water works, and another large part is taken up by a complete copy of the form of report required by the Massachusetts Gas & Electric Light Commission. While these forms are commendable in every way, it appears unnecessary to include them in a book of this sort.

As is well known, the detail required in the management of street railways is probably greater than in the case of any other quasi-public corporation, and but a comparatively small section of the book is given to this subject. It is probable that few kinds of business require the multitude of forms necessary in the management of street railways, and perhaps the strongest criticism to be made of this book is that it shows but few of the forms required. In this connection, the author does not say whether the classification of accounts for this section follows that of the Association of Street Railway Accountants, or is one devised by himself. A statement of this at some point should be made, as the official classification has now been so thoroughly settled, and so generally adopted, that it becomes almost necessary to make use of it in all such reports.

The book should, however, serve a good purpose in indicating the line to take in laying out general forms for the classes of corporations considered.

Armature Ventilation.

For reasons which are difficult to understand, not until relatively recent years have the designers of dynamo electric machinery laid proper stress upon the importance of obtaining the maximum of ventilation if the minimum amount of constructive material is to be used. At the present time, however, active competition by energetic manufacturers has caused every builder of electrical machinery to consider carefully each factor which affects the cost of the completed article, the result being that the excellence of the designs depends almost wholly upon the ventilation obtained.

In its dynamo and motor armatures, the American Engine Company has made special effort to render the ventilation satisfactory. Each armature is provided with a deep air-gap or ventilating channel made midway in its length by blocking apart the laminations to a distance of from .5 in. to 1.25 in. according to the size of the machine. Inasmuch as the coil slots are of the same width at the top as bottom, the teeth are somewhat wider at the top than at their base, as is shown

in Fig. 1. Little bridges of tough fiber board of the form shown in Fig. 2 are driven into the slots over the coils, where they cross the air-gap. The shoulders on these slabs engage the teeth of the core on either side of air-gap,

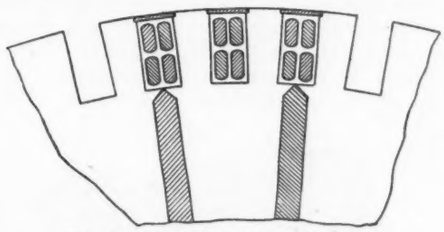


FIG. 1.—ARMATURE CROSS-SECTION.

maintaining the proper distance between them. As the teeth are wider at the top than at the bottom, the shoulders of these bridges do not diminish the effective area of the air duct. Circumferential steel wires with which the armatures are wound to retain the coils in their slots against centrifugal action, secure

FIG. 2.—FIBER BRIDGE.

the ends of these fiber covers. Fig. 3 shows the periphery of the air-gap grated over with the winding bars. At the great speed of rotation of the armature air is thrown radially from longitudinal air spaces along the shaft through spoke-like apertures. Being replaced by air drawn from the spider

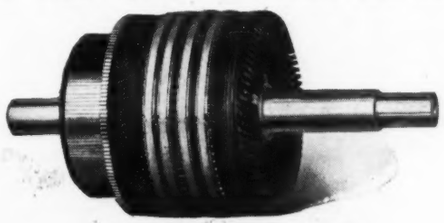


FIG. 3.—COMPLETE ARMATURE.

passage, a rapid circulation is developed. The air rushes into the spider spaces at both ends of the armature and fairly whistles out of the grating-covered radial air-gap, carrying with it whatever heat is developed in the armature coils, and keeping the working temperature very low.

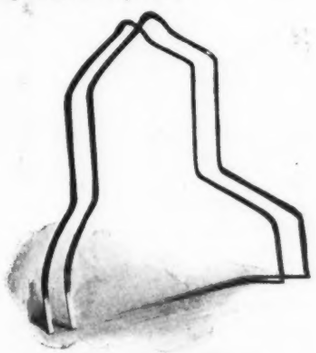


FIG. 4.—ARMATURE COIL.

In the coils of the armature use is made of solid bar copper strips wrapped with cotton thread subsequently impregnated with insulating compound, which method enables larger conductors to be put in the slots than would be possible with the tape-wound insulation. Their construction, which is illustrated in Fig. 4 has been made possible by the development of special machinery for handling double cotton-covered bar copper edge-wire without injuring the insulation.

Pocket Test Lamp.

The test lamp illustrated herewith has been designed for determining whether a circuit is "alive" or not and to locate blown fuses when indicators prove defective and fail to operate. The device consists of a specially designed incandescent lamp enclosed in a fibre casing. This casing has ferrules and knurled binding posts on either end, while at the middle a fair sized hole through both walls of the casing allows the illumi-

POCKET TEST LAMP.

nation of the lamp to be plainly seen. For the majority of switches and fuses the metal ends of the test lamp will bridge the parts of opposite polarity, but for work where the distance is greater than the length of the test lamp the binding posts afford a convenient means for clamping leads of sufficient length.

The above visual indicator has been placed on the market by the Case-Shawmut Company, Newburyport, Mass. It has not been designed for continuous service and should be used only for flashing, because the small enclosed casing will soon become too hot if left long in circuit.

The Strawberry Valley Tunnel Project.

Some of the most interesting engineering work is being prosecuted in connection with the Reclamation Service of the United States Geological Survey. One of the more recent of the reclamation undertakings has been inaugurated near Vernal, Utah, known as the Strawberry Valley project, which includes the irrigation of several thousand acres of productive soil in the southern part of Utah County. A storage dam, having a capacity of about 100,000 acres feet, and reaching a height of 45 ft., will be thrown across the Strawberry River. Water from this reservoir will be led through a tunnel more than three and one-half miles long to the distribution points, where it will be diverted into canals for irrigating the various ranches.

The construction of this dam will make possible the electrical development of a considerable water power, and a power house having a capacity of 2250 kilowatts is contemplated. The power will be used not only for lighting various surrounding small towns, but for motor-driven centrifugal irrigating pumps.

A temporary power house will be erected at once at Spanish Forks, some 33 miles from the construction camp, so that electricity will be available for building operations. The electrical equipment will form the nucleus of the plant which will eventually be installed on the Strawberry River.

The electrical equipment for this temporary power plant will be furnished by the General Electric Company. The initial apparatus includes two 425-kw, three-phase, alternating-current generators, direct-connected to Leffel water wheels. The generators will furnish current at a potential of 11,000 volts to step-up transformers, which in turn will raise the voltage to 22,000 for transmission. Two belt-driven 45 kw generators will supply direct current at a potential of 125 volts for excitation purposes. Switchboard equipment will be provided for both the main station and two sub-stations.

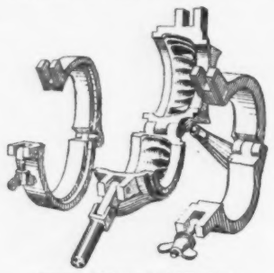
At the sub-stations motor generator sets will be installed for supplying direct current for hoisting motors and other purposes. The motor generator sets consist of 75 kw and 50 kw direct-current machines, each direct connected respectively to a 175 hp and a 125-hp, 2080-volt induction motor. The shafts on the induction motors are extended to take pulleys from which air compressors are belt driven. The compressed air is used for driving rock drills. On account of the double duty which

they perform, the induction motors are of the comparatively large capacity indicated.

Work on the tunnel has already started, but will be greatly facilitated when the temporary power house is completed, since the operations up to the present have been handicapped by the employment of small gasoline engines for power.

Lead Cable Sheath Splicing Machine.

The accompanying illustration shows a wipe-joint machine designed for cable splicing work. The machine consists of three parts, two clamps and a central movable part which does the wiping. The two clamps are attached one to the cable and the other to the sleeve which is to be joined to the cable. The clamps when attached fit the cable and sleeve tightly and are immovable. The central part of the machine can be moved through a complete circle, but in use it is moved back and forth through only an eighth or a quarter of a circle. After the clamps have been adjusted to the sleeve and cable and are holding the central part in place, the machine is heated with an ordinary blow torch. A piece of cold solder placed in the trough melts when the machine is hot enough, usually in a minute or so after the torch is applied. When the solid solder melts, molten solder is poured into the trough and the operator begins the rocking motion which wipes the joint. The corrugations passing over the solidifying solder, force it into a compact mass without holes. As soon as the solder has set, say in two minutes or so, the machine may be removed. This device has been placed on the market by the Ohio Brass Manufacturing Company, Cleveland, Ohio.



WIPE-JOINT MACHINE.

Western Electric Distributing Centre at Pittsburg.

For several years past the Western Electric Company has maintained a sales-office in Pittsburg, the territory embracing Western Pennsylvania and West Virginia. The growth of the business in this part of the country has been steady and the demand for a supply stock at this point became imperative, hence the company's decision to make Pittsburg one of its distributing centers.

A plot of ground of 26,000 square feet, on the Allegheny side of the river, was purchased last fall, and a five-story warehouse and office building has been erected thereon. The building is of the mill type of construction and is equipped with electric elevator service, automatic sprinklers, and heated by natural gas. It represents the most advanced ideas in warehouse construction, affording unexcelled facilities for the handling of goods. The company has a private siding from the B. & O. Railroad running into the premises, and is therefore enabled to make large savings through concentration of goods for in-bound shipment. The location is an admirable one from every point of view, it being but six minutes' ride from the heart of the business district, and within a few blocks of the principal freight and express terminals. The Western Electric Company will here carry a large and complete line of electric and telephone supplies for immediate shipment, and with the present strong position which the company has attained in the Pittsburg district, its business seems destined to be materially developed and increased.

Electrically Driven Laundries.

Although motor drive has now taken a prominent place in machine tool work of all kinds, it is not until comparatively recently that the electric motor has been used to a large extent in laundry work. In this field there are great advantages accruing from the substitution of motors for belts. In addition to the economy of power, ease of manipulation and separate operation, etc., is the very important advantage of cleanliness.

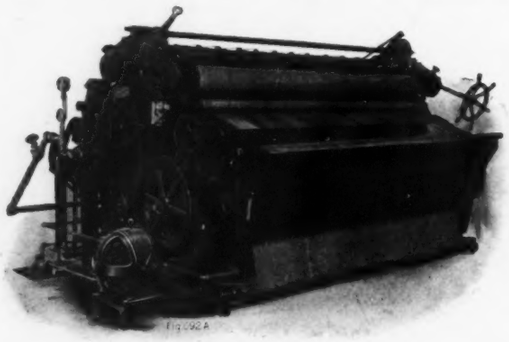


FIG. 1.—ELECTRICALLY DRIVEN MANGLE.

Probably no one but a laundry man can realize the amount of work, expense and vexation caused by clothes being soiled in process of laundering, or how much of this is due to coming in contact with greasy belts, as well as the dust and dirt which naturally results from the various lubricating compositions and the dripping of oil from overhead shafting. The trouble and expense caused by this source of annoyance are enough in many cases to make profitable the use of individual motors.

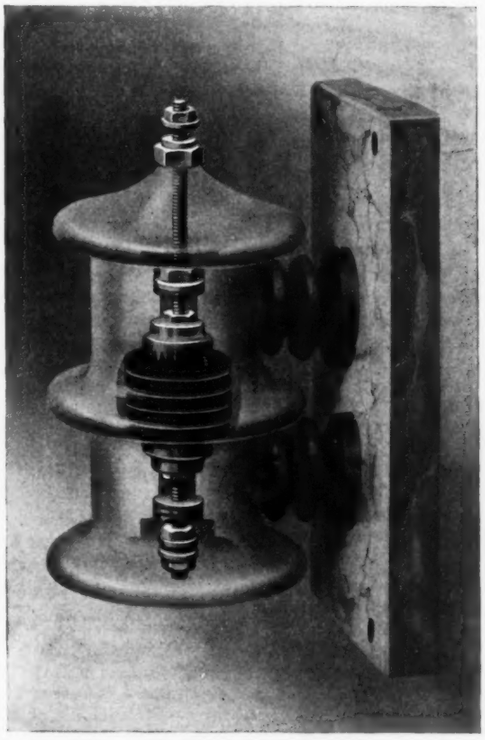
Especially in large hotels, public institutions, clubs, and large commercial laundries which are regularly supplied with electricity, the electric drive is coming into use. In such large plants the saving in energy by the use of individual motors shows a yearly profit of from 30 to 50 per cent on the investment required. In the matter of arrangement of machinery also, the individual motor is the ideal form of drive. The laundry can be so arranged that the clothes can go through all the processes of washing and ironing with the least amount of handling, which cannot be conveniently done when the position of a line shaft prescribes the arrangement of the machinery. The accompanying engravings exemplify the great convenience of this system of drive. One of them shows a motor driven extractor and the other a mangle. They are a few of the applications recently made by the Crocker-Wheeler Company, of Ampere, N. J.

FIG. 2.—ELECTRICALLY DRIVEN EXTRACTOR.

Shaw Non-Arcing Lightning Arrester.

It is the obvious purpose of a lightning arrester to offer a path from line to earth of large capacity and relatively low static resistance, and the manufacturer of the Shaw lightning arrester finds that this is most easily accomplished by the use of conducting or semi-conducting parts interposed by a series of spark gaps of higher electrical resistivity. The company's patents cover the basic principles of a series of partially conducting disks or rings separated by laminar insulating material in such manner as to give the easiest path for a discharge of a static character and present an impenetrable barrier to the dynamic line current of normal voltage.

The portions of the arrester serving as static low resistance conductors, consist of rings resembling carbon, which are treated so as to make them conductors in a class by themselves and yet different from what is commonly known as "non-arcing" material. Each ring maintains an equal spacing



INTERNAL CONSTRUCTION OF ARRESTER.

between its periphery and that of the next succeeding ring in the series. The rings are separated from each other by mica washers, whose superiority over air or other forms of spark gaps, lies in its ability to carry static current by reason of electrolytic capacity, large surface area, non-absorptive nature, and its high insulating qualities which prevent the passage of a dynamic current.

The combination of non-arcing rings and mica disks are mounted on porcelain arbors having strong dielectric properties. The arbors are inserted into the bore of the rings and disks, leaving the peripheries exposed for the easy transmission of static discharges over large surfaces. The arresters are mounted in porcelain housings. For voltages of 1000 and under, the porcelain housings are mounted on a supporting base of wood, while arresters intended for higher voltages are mounted on marble bases.

The arresters are constructed so as to be watertight and dustproof, so that no deterioration ensues. For protection from accident or from malicious persons the instruments are furnished with wooden cases. The arresters, which are designed for voltages as high as 66,000, are made by the Lord Electric Company, of New York and Boston.

Alternating-Current Commutator Motors for Fans.

The Western Electric Company is placing on the market a line of alternating-current fan motors which is claimed to overcome certain difficulties in older types. The motor is provided with a specially constructed commutator and operates in the same manner as the regular series direct-current fan motor.

ALTERNATING CURRENT COMMUTATOR TYPE OF FAN MOTOR.

Thus it differs essentially from the older fan motors which were generally of the single-phase induction type.

The alternating-current fan is equipped with the "universal" feature which allows it to be used either as a desk or bracket fan. A diagonal joint in the standard makes this change possible, as indicated in the illustration. The blades have been designed with special reference to high operating efficiency, the angles being arranged to produce the maximum breeze with the minimum consumption of power. All of the working parts of the motor are completely enclosed, so that it is impossible for dust and dirt to clog up the machinery.

Zoar Storage Battery.

The storage battery plate illustrated herewith has been designed with special reference to the prevention of the loss of material from its surfaces. Each plate is subjected to a "spinning" process, carried on by means of special tools, which insures that the active material will remain attached to the plate after it is once filled in. This plate is the product of the Zoar Storage Battery Company, Zoar, Ohio.

STORAGE BATTERY PLATE.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Weather conditions last week again dominated trade, but reports were irregular, some sections still complaining of unfavorable temperatures, while most despatches reflected the brighter results of tardy sunshine. Similar uncertainty was noted as to progress of the crops, while the cereal markets were responsive to the strengthening influence of a broader foreign demand. Manufacturers continue preparing for future activity, regardless of any temporary interruption to distribution by the weather. The only idle machinery is reported at footwear factories. A few small strikes are also interrupting manufacturers, but in the aggregate a very limited part of the nation's producing power is inactive, and most of the idle machinery is due to the scarcity of labor. In cotton goods and finished iron and steel production is still heavily sold ahead, and where fall trade is inquired into a total volume fully equal to, and in most lines in excess of, a year ago is indicated. Money is easier at all markets, but shifting of loans from west to east points to many banks being well loaned up. Collections improved in spots and this tendency is likely to gain with favorable weather. Deliveries of farm products are larger, and the wheat movement for the fiscal year is in excess of a year ago. It is stated that conditions in the southwest are highly satisfactory. It looks as if the traffic now in sight would give the railroads all they could handle until the next crop moving season, and after that, of course, the volume of traffic would depend largely on the outcome of the crops. The effects of the damage of the winter wheat crop in the southwest, it is stated, have been exaggerated. Where the wheat had been killed it had in a great many instances been replaced by cotton, corn, and other crops, which would serve to offset the loss of wheat. Pig iron markets were quiet, although further large sales of Bessemer pig have been made in the Pittsburg district. Delivery is for the second half of the year, and the business was taken at an advance of $1 per ton. Outside of the Pittsburg district trade is dull. Steel is still very scarce, and Bessemer billets are up 50 cents at Pittsburg. Additional sales of steel rails for delivery this year are light; but one leading railway company has contracted for 153,000 tons for 1908, or 17,000 tons less than was originally ordered by the same company for 1907. Orders for structural material are very heavy, and plates command high premiums for prompt delivery. Domestic copper markets reflect the conditions which have existed for several weeks, unchanged prices and ample business flowing to producers who are open for round tonnages of lake, electrolytic and casting grades. Lake is 26c. for July; Electrolytic for July brought 25 and 25¼c. for home and export business in the week's transactions. Prime casting is scarce for nearby requirements and is strong at 24⅞ and 25c. sixty days. Business failures were fewer last week, the number, as reported by Bradstreet's, being 157 against 167 in the previous week and 177 in the corresponding week last year.

THE STONE & WEBSTER ENGINEERING CORPORATION of Boston, consulting and operating engineers, acting for the Boston Elevated Railway, placed contracts recently for two large Allis-Chalmers direct current railway generators, which rival in size and capacity any machines of a similar type in the country. These machines, which are to be installed in the new extension to the Boston Elevated Railway Company's Lincoln Wharf station, on Atlantic Ave., are to have a capacity of 2700 kw., 600 volts, and operate at a speed of 75 r. p. m. In this station is generated the larger portion of the current used for operating the elevated railway division and the cars through the East Boston tunnel. The generators, which will be driven by vertical cross compound engines, will have armatures of such diameter that they will have to be built up on the ground. Each machine will have 32 poles; will have no band-wires on the armature, and will be equipped with the Allis-Chalmers patented brush and oscillating device by means of which the brushes travel back and forth on the commutator in a direction parallel with the engine shaft, thus keeping the commutator in perfect condition and avoiding the usual wearing grooves.

NEW ELECTRIC LIGHT CONTRACTS.—The W. K. Palmer Company, 717 Dwight Building, Kansas City, Mo., furnishes us with the subjoined list of a few projects, etc., for which it is engineer: Clay Center, Kan., electric light plant, Construction work just beginning. Contracts for equipment were let some time since on their plans and specifications. Holton, Kan., electric light and water works; Plans, specifications and the estimates all prepared and contracts let. Construction has begun. Grand Island, Neb., electric light and water works plant turned over to the city in operating condition April 9. Built entirely according to their plans, specifications and estimates and under their supervision. Junction City, Kan., extension of the electric railway of the Electric Railway, Light and Ice Company. Construction work is going forward under the supervision of one of their engineers. Orange, Tex., lighting and heating plans furnished for J. Oliver Hogg, architect, No. 946 New York Life Building, Kansas City, Mo., for the Lutcher Memorial Church, Orange, Texas. Specifications are on file in the Palmer office.

STEEL CITY ELECTRIC CO.—Owing to the rapid growth of the Steel City Electric Company of Pittsburg, whose plant, located at Third St. and Penn Ave., Pittsburg, has become entirely too small, in spite of the fact that it was running night and day turn in order to keep up with the orders coming in, has moved into its large new building, at 1207 to 1219 Washington Ave., Allegheney, which is a part of Greater Pittsburg. The new building, which will be occupied entirely by the Steel City Electric Company, is thoroughly equipped and is a modern structure for manufacturing purposes. It expects after getting comfortably settled and in first-class running order to be able to take care of its rapid growing business. The specialties that this concern manufactures are the "Star" bushings, water tight floor boxes, "Universal" insulator supports, beam straps, conduit reaming device, conduit benders and locknuts, all of which have become well known to the electrical trade.

PENNSYLVANIA TROLLEYS can hereafter carry freight, and will probably do a large business. The signing by Governor Stuart of the bill to permit trolley lines to carry freight, calls attention to the extent of the street railway mileage in the state of Pennsylvania. There are 56 separate and distinct roads each of which owns or leases 15 or more miles of track. There are many other smaller roads. The aggregate mileage of the 56 large roads is 3,055. Of this about 1,075 is represented by the mileage in the three largest cities—Philadelphia, Pittsburg and Harrisburg.

MICHIGAN ELECTRIC ROAD.—The Detroit, Plymouth & Northville Railway has been acquired by the Jackson, Ann Arbor & Detroit Railway Company, which was organized under the steam railway laws of Michigan with a capital stock of $1,900,000. The purpose of the company is to operate an electric railway from Jackson to Detroit, and from Wayne to Northville. The officers of the company are: Charles W. Osborne, president; W. A. Boland, vice-president; Henry R. Carse, secretary, and N. S. Potter, treasurer.

B. F. STURTEVANT CO., of Boston, Mass., reports recent sales of generating sets to Alton Paving, Bldg. & Fire Brick Co., Alton, Ill.; Minneapolis, St. Paul & Sault Ste. Marie Ry., Minneapolis, Minn.; Votey Organ Co., Garwood, N. J.; The Hermann Mfg. Co., Evansville, Ind.; The Howard Co., New Haven, Conn.; H. J. Kunzig, Philadelphia, Pa.; and Polson Iron Works, Toronto, Ont.

THE CENTRAL LABORATORY SUPPLY COMPANY, Lafayette, Ind., has just closed a contract for the erection of a new brick factory building which is to be completed June 15. The new building will have about four times the present floor space, which is needed to handle the rapidly growing business of the company.

ELECTRIC PROPELLER FANS.—B. F. Sturtevant Company of Boston, Mass., report sales of its electric propeller

fans to Thomas Lee, Cincinnati, Ohio; Taylor's Store, Cleveland, O.; National Malleable Castings Co.; Powers Hotel, Rochester, N. Y.; Rochester Ry. & Lt. Co., Rochester, N. Y., and Baltimore News Office, Baltimore, Md.

ELLSWORTH POWER PLANT.—Contracts have been awarded by the Bar Harbor and Union River Power Company for traveling crane for Ellsworth, Maine, power house, to Niles-Bement-Pond Company and for penstocks and appurtenances to S. Morgan Smith Company, York, Pa. Sellers & Rippey, Philadelphia, are consulting engineers and J. A. Leonard, Ellsworth, is engineer. Specifications for turbine governors and structural steel are to be issued at an early date.

PLANT FOR REEDSVILLE, WIS.—Sealed bids will be received by Mr. Charles Heim, village clerk, Reedsville, Wis., until 7:30 p. m., May 9, for one 45-kw, direct current generator and switchboard; 31,548 feet of copper wire, 10 arc lamps, two 30-hp producer gas engines, one 60-hp suction gas producer, one 300-gal. triplex pump, the construction of 2 miles of pole line, and shafting, friction clutch pulleys and floor stands. A certified check of 5 per cent is required with each bid. The right is reserved to reject any or all bids. Mr. W. G. Kirchoffer, Madison, Wis., is the consulting engineer.

SALES OF ECONOMIZERS.—B. F. Sturtevant Co., of Boston, Mass., has just received from the Interborough Rapid Transit Company a repeat order for standard economizers. The previous order was for the equipment of 26,000 boiler horse power. The total number of tubes to complete both orders will be 11,200 making up approximately 100 carloads. The Williamsbuurg plant of the Brooklyn Rapid Transit Company and the Waterside plant of the New York Edison Company are also to be equipped with economizers by the B. F. Sturtevant Co.

BELL TELEPHONE OUTPUT.—The American Telephone & Telegraph Company's instrument statement for the month of March and three months ended March 31 compares as follows:

	1907	1906	1905	1904
March gross output.....	153,774	188,102	169,159	126,522
Returned	62,836	66,596	47,645	35,043
March net output.....	90,938	121,506	121,514	91,479
Three mos. gr. output...	476,842	526,484	434,094	301,568
Returned	195,654	178,662	132,922	108,990
Three mos. net output...	281,188	347,822	301,164	192,578
Total outstanding 7,389,024		6,046,080	4,781,736	3,972,095

LARGE FOREIGN TRADE.—The chief of the Bureau of Statistics, Department of Commerce and Labor, reports the foreign commerce of the United States for March, and for the nine months ended March 31, as follows:

MERCHANDISE.

March	1907	1906	1905
Imports $133,323,085		$113,625,066	$110,431,188
Exports 162,689,950		145,522,342	136,978,429
Excess exports .....$ 29,366,865		$ 31,897,276	$ 26,547,241
Nine months ended March:			
Imports $1,066,059,911		$ 913,584,586	$ 839,430,114
Exports 1,451,904,971		1,343,913,725	1,145,039,237
Excess exports .....$ 385,845,060		$ 430,329,139	$ 305,609,123

SUBWAY EXTENSIONS.—The New York Rapid Transit Commission have awarded the contract for a section of the subway loop connecting the Williamsburg and Brooklyn Bridges to the Degnon Contracting Company, which was the lowest bidder. The work is in Centre Street between Pearl and Canal Streets and the contract price is $3,035,000. Counsel reported that in order to construct the three additional tracks on the Broadway subway between 96th and 103d Streets to relieve the congestion at the 96th Street express station, the board would have to use the same proceedings as if a new route were being acquired. This will involve the obtaining of consents from adjoining property owners, or failing to obtain them, appeal must be made to the Appellate Division of the Supreme Court.

ALLIS-CHALMERS STEAM TURBINE UNITS.—Contracts obtained during the past month included seven units, comprising standard Allis-Chalmers steam turbines, direct coupled to Allis-Chalmers alternating current generators. The Citizens' Light, Heat & Power Company, Johnstown, Pa., has ordered a 1000-kw turbo unit, and the Delaware, Lackawanna & Western R.R. has ordered a 2000-kw turbine and alternator for use in the Hampton collieries about two miles out of Scranton, Pa. Five of these contracts are for units of 500 kw capacity and for service in widely distant portions of the country. One 500-kw unit was contracted for by the Bisbee Improvement Company, of Bisbee, Ariz., another goes to the Binghamton Light, Heat & Power Company, of Binghamton, N. Y. A third 500-kw unit will be installed at Galveston, Texas, at the power plant of the Brush Electric Light & Power Company, while a fourth unit will be placed in the power house of the Northampton Electric Lighting Company, Northampton, Mass. The Savannah Lumber Company, of Savannah, Ga., will install a 500-kw unit, which is to be a duplicate of one ordered some time ago and now being placed in operation.

SHOPS FOR SANDY HOOK, N. J.—Award has been made of a contract for a set of shops for the War Department at Sandy Hook Proving Ground to the department of general contracting of the Standard Engineering Company, Philadelphia. This work includes a machine shop, slow burning construction, 325 x 50, equipped for gun repair work, a plumbing, carpenter and paint shop, 175 x 50, and a power house, 150 x 50 installed with Smith boilers, Ball engines, Crocker-Wheeler generators, Walker switchboard. The Cryer system of low pressure steam heat is to be installed throughout. The Standard Company also reports that its engineering department has considerable work on hand, including quite an extensive project in the line of a paper mill, which will no doubt be carried through this summer. The company has also just received a number of contracts, including electrical equipment of several Government boats, the modernization and equipment, with motor drives, of two large plants.

ALLIS-CHALMERS STEAM TURBO UNITS.—The steam turbine shops, erecting and testing floors at the West Allis works of the Allis-Chalmers Company present a busy appearance, these days, caused by the increase in orders for Allis-Chalmers steam turbines since the first of the year. During the month of March more contracts for turbo-generator units were taken than for any similar period since the building of turbines was begun by the company, and the orders received for April bid fair to double the March sales. The facilities and organization available for this service have been developed to a high state of efficiency. Three 1000-kw, 1800-r. p. m. turbines have been shipped to the Western Canada Coal & Cement Company, near Calgary, Canada, and will be ready for operation early in May. A 1000-kw, 1800-r. p. m. steam turbine has been erected and put in readiness for operation in the power plant of the National Cash Register Company, Dayton, Ohio, and only waiting for the necessary condensing outfit and steam connections. Units ranging in capacity from 900-kw to 5000-kw, have reached various stages near to completion in the shops, for the Jamestown Woolen Mills, Jamestown, N. Y.; Savannah Lumber Company, Savannah, Ga.; Flatbush Gas Company, Brooklyn, N. Y.; Indianapolis New Castle & Toledo Ry., New Castle, Ind.; Halderburg Cement Company, Howe's Cave, N. Y.; Kings County Electric Light Company, Gold St. Station, Brooklyn. A number of other recent large orders have already been noted.

WINNIPEG POWER PLANT.—Sixty-five miles from Winnipeg, Manitoba, Canada, on the Lac du Bonnet River, is what experts have described as "one of the most modern water power installations on the continent." It was in 1901 that the Winnipeg Electric Company conceived the idea of harnessing the waters of the Winnipeg River with a view to furnishing electrical energy to Winnipeg, Manitoba. In 1905 this company amalgamated with the Winnipeg Electric Street R. R. Company and from then on the development proceeded without interruption. To obtain the necessary water a channel had to be cut to the upper river, near Otter Falls, 120 feet wide, with a clear depth of 8 feet at normal low water. The channel was 8 miles long with a drop of 5 ft. to the mile, equalling a total head of 40 ft. In cutting this channel it was necessary to blast with dynamite about 447,000 cu. yds. of granite, which was lifted out of the passage way by means of derricks. With the rate of flow of water through this channel, and the available head, there can be developed 30,000 hp. To maintain the levels the year round the water was backed eight miles above the power house by means of cofferdams to an average depth of between eight and nine feet. The electrical apparatus is fully modern and complete in every detail. The main units in the power house consist of four 1000-kw and five 2000-kw revolving field 60-cycle, 2300-volt, three-phase generators, coupled to turbines; 100-kw, 125-volt direct current exciters coupled to turbines, and two 175-kw, 125-volt exciters coupled to three-phase, 2300-volt induction motors. The switches are sectional and are separated by walls. There are fifteen transformers,

comprising two banks of 1100 hp and three banks of 2400 hp. The voltage in operation is stepped up from 2300 volts to 60,000 volts for transmitting to the sub-station at Winnipeg. The power and transforming houses are absolutely fireproof, being built of structural steel and brick throughout. The general arrangement of the sub-station in Winnipeg is the same as that at Lac du Bonnet. From the power house there are run duplicate transmission lines, the steel towers being similar to those used by the Toronto & Niagara Power Company between Toronto and Niagara Falls. The span crosses the Winnipeg River with a span of about 760 feet on 72 ft. towers, each weighing about 6 tons. The standard towers are placed 500 feet apart and are 40 ft. high. Each tower weighs about 2400 pounds. The cost of the complete plant will amount to about $4,000,000.

PRICE OF PLATINUM.—The statement has been made rather frequently of late that platinum has fallen off in price. One of the leading New York refiners in a letter to the daily press denies this and says:—"While there has been a slight change or drop in the price of platinum it has been entirely local and not through any cause or condition of a betterment of the Russian situation, either in the matter of increased production or a decrease in price. The foreign situation is no better than it was several months ago when the prices were very high here, *i. e.*, between $38 and $40 per ounce. In fact foreign prices for ore to-day are higher than they were then and very much higher than the price quoted for metal to-day in this market. We consider that the change in price here is almost without warrant. Being one of the largest platinum producers both in this country and abroad and having direct communications with the Russian situation, we feel that we know the situation pretty well and there is everything in the condition of the foreign market to warrant much higher prices than we have seen before, which we believe will be the case within a few months. We are afraid that if the trade is inclined to place any reliability in the former statements and are waiting for lower prices that they will have to pay much higher prices in the very near future rather than lower prices. From all sources of information it is very evident that the field of platinum ore supply is decreasing each year, which in itself would substantiate the report from this source that the value of platinum from time to time during the future would naturally increase in price rather than decrease."

NEW WRAPPING MACHINERY.—The Consolidated Wrapping Machine Company has been formed recently at Springfield, Mass., with a capital stock of $500,000. Among the directors is Mr. Robert W. Day, president of the United Electric Light Company of Springfield, Mass., and Mr. F. Z. Maguire, well known in electrical and telephonic circles on both sides of the Atlantic. The inventor of the machines was Richard Berger of Brooklyn, N. Y., who made many improvements on the Mergenthaler linotype machines. They cost from $1,500 to $3,000 each. In the wrapping of the products for which they are designed it is necessary in many cases that the articles be practically air-tight, in order that they may not deteriorate from exposure while being placed on the market. For example, the package of ordinary chewing gum consists of five pieces of gum. The machine, driven usually by electric motor, automatically takes the five pieces, wraps them with waxed paper and tin foil, and places a band around the package, which is sealed in the same operation. It does this work at the rate of 40 to 50 a minute; in other words, one machine will do the work of from 8 to 12 girls and do it more accurately.

CONDUITS IN NEW YORK.—The New York State Court of Appeals has affirmed the judgment of the courts below in sustaining the right of the Longacre Light and Power Company to place in the conduits of the Consolidated Telegraph and Electrical Subway Company cables containing its wires from 548 West Forty-second street, New York city, to Seventh avenue and then to the Criterion Theater on Longacre Square. The Consolidated Company was authorized by the city of New York to sublet space for wires of any other company, but refused it to the Longacre Company. The argument upholding the refusal was on the ground that the Longacre Light and Power Company had no franchise from the Board of Aldermen. The latter company claimed that there was a grant under the consent of the Board of Aldermen. All courts have now sustained the application of the Longacre Company for a mandamus compelling the Consolidated Company to admit its wires to its subways. It remains to be seen what actual effect this decision will have on the lighting and conduit situation in New York.

THE NEW SAYRE COLLIERY.—After several weeks of experimental tests and trials the new Sayre colliery of the Lehigh Valley Coal Company near Mt. Carmel, Pa., is ready to be placed in full operation. The shaft is 589 feet deep, with one tunnel about 1500 feet long from the first lift, cutting all the seams in the Montana Basin, and another driven southward from the second lift to the old Mt. Carmel workings. Later tunnels will be run to the Sioux operation from the third level. Sioux coal is now carried overland. The underground haulage is to be accomplished by heavy electric locomotives. From the self-dumping cages of the shaft, the coal is carried to the breaker by a bucket conveyor running at a speed more than 100 feet a minute and capable of handling 4000 tons of coal a day. The mine workings are ventilated with a 20-foot fan, which delivers about 200,000 cubic feet of air per minute. The pump house and engine houses are all thoroughly fireproof and every part of the colliery is built and equipped on the most up-to-date plans.

MOTORS FOR OPERATING GIANT VALVES.—The electrically operated valve is a mechanical refinement demanded by the size of recent hydraulic and hydro-electric developments, where the necessary control of vast volumes of water requires valve openings which it would be practically out of the question for the station attendants to operate without the application of power. About 120 miles from the city of Los Angeles, Cal., on the cañon of the Kern River, the new power house just being completed by the Los Angeles Edison Company is practically ready to supply electric power to the city from approximately 43,000 horsepower in Allis-Chalmers horizontal water wheels. The power plant will be equipped with valves electrically operated by means of eight type "K" Allis-Chalmers direct current motors. They will be used on 28-in. gate valves built by the Risdon Iron and Locomotive Works, of San Francisco. These motors are of the vertical type, series wound, 4 hp each. They are totally enclosed and so arranged that they may be controlled directly from the power.

CHICAGO TRACTION APPARATUS.—Following the defeat of municipal ownership at the recent election in Chicago, the Chicago City Railways Company has purchased of the General Electric Company, 1200 direct current railway motors with controlling apparatus for the operation of 300 new cars. Power for the new rolling stock will be supplied by additional electrical generating machinery aggregating 6000 hp. Each car will be equipped with four 40-hp motors, this size of motor being the standard for urban railways.

PLANT FOR SUPERIOR, WIS.—The city of Superior, Wis., contemplates building a municipal electric light and power plant of about 1000 hp capacity. Plans and specifications will be completed about May 20. Mr. Victor Linley is mayor. Mr. Owen Ford, Security Building, St. Louis, Mo., is consulting and supervising engineer.

TELEPHONY IN BRAZIL.—The president of the state of Sao Paulo, Brazil, has signed a decree granting a concession to Señor Antonio Witzel, of Sao Paulo, for the establishment of a telephone line to link up the cities of Bebedouro, Barretos, Jaboticabal and Pitangueiras.

Financial Intelligence.

THE WEEK IN WALL STREET.—There was a strong undertone, though the market was dull and narrow. Prices advanced materially in some cases. Trading, however, was professional and centered in a few issues, Union Pacific being the most prominent. Some effect was also produced by certain of the anti-railroad legislative measures. Brooklyn Rapid Transit, for instance, was a weak feature on the passage of a bill at Albany compelling it to adopt a 5-cent fare to Coney Island. Similarly, Chicago-Great Western sold down sharply on a severely adverse report on its capitalization and finances made by a committee of the Minnesota legislature. Sentiment, however, was favorably influenced by easy money and good business prospects, adverse crop reports from certain sections having apparently little weight. There was a better feeling among electric stocks and the market was stronger. A majority of the securities closed at higher quotations, but in no case was the

gain large. Prices on the curb market fluctuated within a narrow range for the most part, with strength early in the week followed by a slowly sagging tendency, under liquidating sales. Chicago Subway was heavy and reacted more than 3 points with the same kind of selling that prevailed earlier in the year. Following are the quotations of April 30:

NEW YORK.

	Apr. 23	Apr. 30		Apr. 23	Apr. 30
Allis-Chalmers Co.	12¼	11	General Electric	148½	148½
Allis-Chalmers Co. pfd.	34	30⅛	Hudson River Tel.	—	—
American Dist. Tel.	—	—	Interborough Met. com.	25½	25
American Locomotive	64	63½	Interborough Met. pfd.	60¼	59½
Amer. Locomotive pfd.	105	106	Mackay Cos.	—	—
American Tel. & Cable.	75	75	Mackay Cos., pfd.	—	69¼
American Tel. & Tel.	—	—	Marconi Tel.	—	—
Brooklyn Rapid Transit	60⅜	59½	Metropolitan St. Ry.	—	—
Electric Boat	25	25	N. Y. & N. J. Tel.	—	—
Electric Boat pfd.	78	78	Western Union Tel.	83¼	82¾
Electric Vehicle	—	—	Westinghouse com.	144⅛	144
Electric Vehicle pfd.	—	—	Westinghouse pfd.	—	—

BOSTON.

	Apr. 23	Apr. 30		Apr. 23	Apr. 30
American Tel. & Tel.	123½	122¾	Mass. Elec. Ry. pfd.	59½	59
Cumberland Telephone.	117½	107½	Mexican Telephone	—	2¼
Edison Elec. Illum.	211	206	New England Telep.	120	121½
General Electric	150	149½	Western Tel. & Tel.	7	—
Mass. Elec. Ry.	—	—	West. Tel. & Tel. pfd.	70	—

PHILADELPHIA.

	Apr. 23	Apr. 30		Apr. 23	Apr. 30
American Railways	49½	49¾	Phila. Electric	8⅝	8⅝
Elec. Co. of America	10	10	Phila. Rapid Trans.	19	21¾
Elec. Storage Battery	53½	52½	Phila. Traction	94	94½
Elec. Storage Bat. pfd.	—	—			

CHICAGO.

	Apr. 23	Apr. 30		Apr. 23	Apr. 30
Chicago City Ry.	180	180	National Carbon	76	71
Chicago Edison	143	—	National Carbon pfd.	*111	111
Chicago Subway	17½	17	Union Traction	—	—
Chicago Tel. Co.	—	130	Union Traction pfd.	—	—
Metropolitan Elec. com.	24	24			

*Asked.

PACIFIC TELEPHONE AND TELEGRAPH.—The annual report of the Pacific States Telephone and Telegraph Company for the year ended December 31, 1906, is in many respects a very significant and encouraging statement. In April, 1906, the Pacific States Company suffered in the San Francisco fire a very severe loss. The 51,000 stations in San Francisco representing a yearly gross revenue of at least $2,000,000 were wiped out of existence. In spite of this fact that the company should close the year with gross earnings actually $40,000 greater than for the previous year, and with a gain of 16,328 stations in its territory is one of the most encouraging evidences as yet afforded of the stability of telephone earnings. During 1906 the company increased the book value of its plant $2,024,851 to $29,213,697. At the same time the total cash expenditure on plant and real estate during the year was $5,523,082, of which $2,996,872 is represented by an increase in floating debt, while the balance came out of earnings and surplus. The plan for the reorganization of the Pacific States Telegraph and Telephone Company was worked out during the year, and on Jan. 2, 1907, the new company formally superseded the old. The gain by the reorganization is that the question of financing the growth of the Pacific Coast States is now well provided for by the issuance of 5 per cent bonds. A total of $10,000,000 bonds have already been sold to the bankers, and with the cash received from their sale and $1,000,000 preferred stock the $8,658,405 floating debt will be retired, and a balance left large enough to provide for the greater part of the 1907 requirements. During 1906 the company paid one dividend at the rate of 7 per cent, passed the next quarter owing to the loss of its books in the fire, and paid the last two quarters at the rate of 5 per cent per annum. The year's results show that the 7 per cent rate could have been maintained without difficulty. The following table shows some of the more important factors in the company's operations during the last three years:

	1906.	1905.	1904.
Stations	258,446	242,088	206,040
Gain	16,328	36,048	28,037
Per cent gain	6.7	17.4	15.7
Gross	$7,731,615	$7,687,523	$6,824,506
Gross per station	30.90	34.20	31.10
Capitalization	39,000,000	18,000,000	15,976,000
Capitalization per station	150	74	82

The gross receipts per station are very low, about $15 below the average of all the Bell companies. This figure will show a substantial increase during 1907.

U. S. STEEL REPORT.—The report of the U. S. Steel Corporation for the first quarter of 1907 makes a splendid showing as to its own and general conditions of business. The past quarter was the best first quarter of the year in the history of the company. The net earnings for the three months ended March 31 were $39,122,492, compared with $36,634,490 in the corresponding period in 1906, and with $41,744,964 for the last three months of 1906, the company's banner quarter. The common stock dividend was left unchanged. The unfilled orders on hand on March 31 amounted to 8,043,858 tons, a falling off of about 440,000 tons compared with the orders on hand at the close of the previous quarter, but over 1,000,000 tons in excess of the orders at the same date last year. From the net earnings of the quarter, amounting to $39,122,492, there was deducted $5,154,521 for sinking funds and ordinary depreciation, including $1,000,000 charged to special improvement and replacement fund, and $6,936,963 interest on United States Steel bonds, &c., leaving a balance of $27,031,008 available for dividends. From this there was deducted the quarterly dividends of 1¾ per cent on the preferred stock and one-half of 1 per cent on the common, calling for $8,846,432, leaving a surplus of $18,184,576 for the quarter. Out of this $14,500,000 was appropriated on account of expenditures for acquisition of additional property, for new construction, and for the discharge of capital obligations. This appropriation compares with $15,500,000 set aside for similar purposes out of the earnings of the previous quarter, and with an appropriation of $10,500,000 in the corresponding quarter of 1906. The final surplus for the quarter was $3,324,545.

BELL TELEPHONE PRESIDENCY.—General surprise was caused this week by the announcement that Mr. Frederick P. Fish had resigned as president of the American Telephone and Telegraph Company and the Western Company also. His place will be taken by Theodore N. Vail, who was the first president of the company, and who for many years has served on the Board of Directors. In resigning from the presidency, Mr. Fish stated that for more than two years he has been waiting for a favorable opportunity to retire and to resume the practice of law. This opportunity came, he added, when he found that a competent man was available as his successor. He will continue to serve the company as one of its legal advisers. Mr. Vail made a great business reputation in the early days of Bell telephone development, and his return to the helm is supposed to portend some big deals and consolidations. It is rumored but denied that now the Bell and Mackay systems will be brought together.

TROLLEYS IN ENGLAND.—J. G. White & Co., Limited, of London, have entered into an arrangement with the Luton municipality, England, for the construction and operation of an electric traction road. The initial road will be six miles long. The overhead system will be employed. The contract price is $300,000. The White Company contracts to pay all interest and sinking fund charges on the loan and 20 per cent of the net profits earned to the corporation. The contract is for five years, with the option of renewal for ten years more.

THE PRICE OF COPPER.—Commenting on a recently reported interview with Mr. George Westinghouse, the *Wall Street News* says:—"Instructive on the real copper metal situation are these remarks by an official of a prominent electric manufacturing company, which buys millions of pounds of copper a year. The official says: 'I do not look for any serious decline in copper prices this year. As a matter of fact it would not surprise me if prices did not go below present level.'"

DIVIDENDS.—The directors of the American Gas & Electric Co. have declared the regular quarterly dividend of 1½% on the preferred stock, and an additional dividend at the rate of 6% per annum on said stock from January 16 to February 1, payable May 1. Directors of the Butte Electric & Power Co. have declared the regular quarterly dividend of $1.25 on the preferred capital stock payable May 1.

KANSAS CITY EARNINGS.—The Kansas City Railway & Light Company's report for March and ten months (June 1 to March 31) is as follows:

	1907.	1906.
March gross	$478,464	$407,630
Expenses	258,894	219,231
March net	$219,570	$188,399
Charges and taxes	152,052	135,907
Ten months gross	$4,573,616	$4,265,750
Expenses	2,385,948	2,123,153
Ten mos. net	$2,367,668	$2,142,597
Chgs. and taxes	1,464,064	1,365,062
Ten mos. surplus	$903,604	$777,535

MESSAGE RATES.—Advices from Boston call attention to the fact already pointed out in these columns that while the telegraph companies have been raising rates the telephone companies have been lowering their charges. A ten-year compari-

son of the annual statements of the American Telephone and Western Union Telegraph companies will illustrate the contrary tendency of telephone and telegraph rates. The telephone figures follow:

	1905	1895	Dec.
Gross per station	$46	$80	$34
Average calls per station yearly	2,218	2,940	722
Average cost per call	2.0c	2.7c	.7c

The change in Western Union message charges in the same period may be shown thus:

	1906	1896	Inc.
Offices	24,323	21,725	2,598
Messages per office yearly	2,939	2,704	235
Average cost per message	31.6c	30.9c	.7c

The Western Union year ends June 30, while the American Telephone fiscal year coincides with the calendar year. The comparison therefore gives the Western Union six months' advantage. The yearly increase in telegraph messages between 1895 and 1905 was 3 per cent, but in telephone messages it was 47 per cent.

AM. LIGHT & TRACTION.—The American Light & Traction Company has issued its regular quarterly statement for the three months ended March 31. The figures compare with former years as follows:

	1907	1906	1905
Earn. of sub. cos	$571,519	$549,879	$252,719
Misc. earn., int., etc	56,496	52,140	36,336
Total gross	$628,015	$602,019	$289,055
Expenses	12,000	12,000	7,500
Net	$616,015	$590,019	$281,555
Preferred div.	213,543	212,650	140,953
Common div.	84,508	67,428	35,106
Reconstruct res.	176,500	180,100	.....
Total deduct.	$474,551	$460,178	$176,059
Surplus	141,464	129,841	105,496

The surplus and earnings account for the year ended March 31, 1907, shows as follows:

Surplus March 31, 1906	$2,258,719
Net surplus for year ended March 31, 1907	372,888
Profit and loss surplus April 1, 1907	$2,631,607

The company is earning over 13 per cent on its $6,670,700 common stock after the payment of the preferred dividends.

RUTLAND, VT., EARNINGS.—The Rutland Railway, Light & Power Company has issued a statement of earnings for the years ended March 31, 1907 and 1906, as follows:

	1907	1906	CHANGES
Railway Company:			
Gross	$105,154	$93,726 Inc.	$11,428
Expenses	56,003	55,370 Inc.	633
Net	$49,151	$38,356 Inc.	$10,795
Gas Company:			
Gross	$31,624	$28,755 Inc.	$2,869
Expenses	22,340	20,551 Inc.	1,789
Net	$9,284	$8,204 Inc.	$1,080
Electric Water Power Co.:			
Gross	$23,692	.....	.....
Expenses	9,707	.....	.....
Net	$13,985	.....	.....
Rutland City Electric Co.:			
Gross	$60,883	$57,635 Inc.	$3,248
Expenses	42,404	39,269 Inc.	3,135
Net	$18,479	$18,366 Inc.	$113
Total all companies:			
Gross	$221,354	$180,117 Inc.	$41,237
Expenses	130,455	115,190 Inc.	15,265
Net	$90,899	$64,927 Inc.	$25,972

NEW WESTINGHOUSE STOCK.—The directors of the Westinghouse Electric & Manufacturing Company have decided to offer to stockholders of record on May 4, $5,000,000 par value of assenting stock at $75 per $50 share. In fixing the price at $75 per share, the directors could not overlook the fact that the company's convertible sinking fund bonds are convertible into the stock of the company on the basis of par for bonds and 200 per cent for assenting stock ($100 for each $50 share), and the further fact that when $15,000,000 of these bonds were offered, the subscriptions amounted to over $60,000,000, which, with the price these bonds have since commanded, indicate that the privilege of conversion has a very substantial value in the minds of investors. An officer of the company states that the directors had full confidence that the stockholders would take the entire issue. No syndicate has been formed to underwrite it. If the stock is all taken at the premium demanded, the issue will supply $7,500,000 of new funds which will be devoted to improvements and extensions of the Pittsburg plant.

EDWARDS HEADLIGHT.—Mr. E. J. Widdell, La Porte, Ind., receiver of the Edwards Electric Headlight Company, has issued notice that he will, by virtue of an order of the La Porte Circuit Court, offer for sale at private sale on Friday, at 10 o'clock a. m., on the 3d day of May, 1907, and continuously thereafter until sold, at the office of Truesdell & Sallwasser, attorneys, at La Porte, Ind., all the machinery, tools, fixtures, stock of goods, material, raw, finished and in process of completion, gasoline engines, electric headlights, bills payable, accounts, contracts, patents and choses in action, and all personal property of every kind belonging to the Edwards Electric Headlight Company. The said property is to be sold for cash, or one-third cash and balance in six or nine months, and as a whole, or in parts, according to the discretion of the receiver, and all such sales to be subject to the confirmation of the court.

MERGER IN INDIANA.—On April 20, consolidation of the Michigan City and Northern Indiana Gas Company, the Michigan City Light and Power Company, the Michigan City Gas Light Company and the Michigan City Gas Company was effected by the filing of articles of incorporation in the office of La Porte County recorder, La Porte, Ind., by the Michigan City Gas and Electric Company, with a capital stock of $700,000. The new corporation belongs to the Geist syndicate. The incorporators and directors are: Clarence H. Geist, of Philadelphia, and H. B. Hurd, Walter F. Booth, H. S. Schutt and Rolte M. Cole, of Chicago. The new company will control all gas and electric light and power business in Michigan City and northern Indiana cities.

NORTHERN OHIO EARNINGS.—The Northern Ohio Traction & Light Company's report for March and three months compares as follows:

	1907	1906	CHANGES
March gross	$133,833	$113,167 Inc.	$20,666
Expenses	83,215	78,585 Inc.	4,630
March net	$50,618	$34,582 Inc.	$16,036
Charges	41,290	39,947 Inc.	1,343
March surplus	$9,328	*$5,365 Inc.	$14,693
Three mos. gross	$375,882	$334,607 Inc.	$41,275
Expenses	235,506	224,371 Inc.	11,135
Three mos. net	$140,376	$110,236 Inc.	$30,140
Charges	124,029	119,841 Inc.	4,188
Three mos. surplus	$16,347	*$9.605 Inc.	$25,952

*Deficit.

BAHIA TRAMWAY PROJECT.—The Bahia Tramway, Light & Power Company, recently incorporated in Maine with a capital of $3,500,000, has completed arrangements for the construction and operation of a street railway system in the Brazilian city which will call for an expenditure of $10,000,000. The company has an authorized issue of $7,500,000 fifty-year 5 per cent bonds, of which $3,500,000 have been offered in London and Brussels at 90½. Some of the financing, it is said, will be undertaken in New York, and among the New Yorkers mentioned as interested in the enterprise is W. Lanman Bull, who has already large interests in Latin America.

NIAGARA FALLS POWER.—The State gas commission has given a hearing on the application of the Niagara Falls Power Company for consent to issue six per cent debentures, series C, to the aggregate amount of $5,000,000 against a similar amount of debentures of the Canadian Niagara Power Company and also to acquire 594 shares of the stock of the Tonawanda Power Company. A further hearing will be held on May 7.

PORTLAND, ORE., BONDS.—Redmond & Co. are offering to investors $200,000 first and refunding 5 per cent gold bonds of the Portland Railway Company, dated November 1, 1905, and due November 1, 1930. The total amount of the above bonds outstanding is $6,227,000. These bonds are an underlying lien of the Portland Railway, Light and Power Company, of Portland, Ore.

ELECTRIC CO. OF AMERICA.—The Electric Company of America reports for the year ended Dec. 31, 1906, with comparisons as follows:

	1906	1905	1904
Gross earnings	$592,965	539,190	470,565
Net after chgs	471,455	440,931	408,901
Dividends	299,780	285,535	244,719
Surplus	171,674	155,425	164,182
Surplus Dec. 31	1,099,322	927,648	772,222

ELECTRICITY IN SIAM.—The annual report of the Siam Electricity Company states that the gross profit was 1,030,852 ticals (silver tical worth about 30 cents), and net profit 666,884 ticals. A dividend of 12 per cent was declared and 92,328 ticals carried forward.

GENERAL NEWS

Construction News.

STEVENSON, ALA.—L. T. Henniger, mayor, writes that Graham Brothers, of Stevenson, have secured a franchise for water works and an electric light plant.

VALDEZ, ALASKA.—W. H. Crary, town clerk, writes that Portland parties have petitioned for a franchise for water works and an electric light plant for Valdez.

MAGNOLIA, ARK.—The Magnolia Telephone Company has been organized, with R. L. Morris, president.

ALTURAS, CAL.—Plans are being made by the Alturas Electric Light & Power Company for installing a larger water wheel in its plant.

BERKELEY, CAL.—A power plant, costing $125,000, is to be installed at the new Hotel Claremont. M. P. Thye, a consulting engineer of Los Angeles, has charge of the work. There will be three engines with a combined capacity of 450 horse-power. The plant will be used for the electric lighting, steam heating, elevators, fire pumps and ice plant, laundry and other mechanical features of the building.

FRESNO, CAL.—A franchise has been granted by the Board of Trustees to the Monterey, Fresno & Eastern Railway for a right of way through this city.

FRESNO, CAL.—The Pacific States Telephone & Telegraph Company is making extensive improvements to its system in Fresno and vicinity which will cost about $48,000.

HOLLISTER, CAL.—The Board of Trustees has granted a franchise to the Monterey, Fresno & Eastern Railway Company to construct and operate a railway over certain streets of the city.

LOS ANGELES, CAL.—The Board of Trustees has granted a franchise to H. E. Huntington to construct and operate an electric railway in this city.

RICHMOND, CAL.—A new electric railway is to be built in this city this summer. The John Nicholl Company is interested in the enterprise.

SAN FRANCISCO, CAL.—F. H. Varney, engineer of the San Francisco Gas & Electric Company, writes that bids will be received about May 15 for rebuilding the power house recently destroyed by fire, to cost about $200,000.

SANTA CLARA, CAL.—At an election held recently the citizens voted to issue $21,000 in bonds for repairs to the municipal electric light and water works plant.

SANTA CRUZ, CAL.—The Coast Counties Light & Power Company is planning to establish a large central power plant on Big Creek, with a large sub-station or distributing plant at Santa Cruz and a smaller auxiliary plant at Watsonville to be used in emergency. The capacity of the hydro-electric plant at Big Creek will be doubled, for which plans have been drawn. The auxiliary plant now in use at the Casino in Santa Cruz will be brought to Watsonville. R. H. Sterling is general manager of the Coast Counties Light & Power Company.

STOCKTON, CAL.—The American River Electric Company has begun work on a large auxiliary electric plant which will be located on the north bank of the Stockton channel and cost about $250,000. The main building will be of re-enforced concrete and steel. During the recent high water the entire plant was under water and badly disabled and the service of the company was interrupted for several days.

BOULDER, COL.—J. W. McCreery, of Greeley, writes that the Electric & Hydraulic Company of Colorado Springs is interested in the construction of three reservoirs in Boulder Cañon for irrigation and power purposes.

COLLINSVILLE, CONN.—At a special town meeting held April 19 the citizens voted to authorize the Selectmen to enter into a contract with the Union Light & Power Company, of Unionville, to furnish electricity for lighting the town. The company is to supply 60 50-cp Nernst lamps at a total cost of $906 per year.

NEW HAVEN, CONN.—Plans have been announced by the Consolidated Railway Company for the improvements to the power house on Grand Avenue, which include the enlargement of the building and the installation of new machinery and boilers. A contract has been placed for four 700-hp Bigelow boilers. Two 1500-hp engines will also be installed in the new plant. The cost of the work is estimated at $200,000.

STONINGTON, CONN.—Barber & Rittenhouse are contemplating operating their plant by electricity.

WINDSOR LOCKS, CONN.—The Legislature has passed a resolution amending the charter of the Northern Connecticut Light & Power Company, which permits the company to manufacture and distribute electricity and gas in several towns in the State.

WASHINGTON, D. C.—Bids will be received until May 24 by the Building Commissioner, U. S. Department of Agriculture, for furnishing lighting fixtures for the two laboratory buildings for the U. S. Department of Agriculture, Washington, D. C. B. T. Galloway is chairman.

JACKSONVILLE, FLA.—At a special election held April 16 the citizens voted in favor of the ordinance granting the Jacksonville Electric Company the privilege of extending its lines in different parts of the city.

ATLANTA, GA.—The Georgia Railway & Electric Company has recently installed a 3000-hp gas engine at the Davis Street Power plant, to be used as an auxiliary to the water power plant of the company. The company will soon install a steam turbine of 3000 horse-power in the same station.

ATLANTA, GA.—Bids will be received until May 6 for city lighting for one year; also the submission of separate bid stating maximum rate at which electricity for lighting and power for commercial purposes will be supplied to the general public. The last named bids to cover contracts for a period of one, two, three and five years.

MOULTRIE, GA.—The Town Council at its last session granted Wm. Scandrett, J. Z. Jackson, J. J. Parrish, Jr., and others a franchise for the purpose of building an interurban street railway system in Adel.

BOISE, IDAHO.—It has been stated that the Twin Falls North Side Company will build an electric railway from Milner to Goodings and Bliss, a distance of about 60 miles. Engineers are now at work on the line.

BEARDSTOWN, ILL.—A contract has been awarded to George F. Goodnow, of Chicago, for the construction of an electric light and gas plant in this place.

CARMI, ILL.—The White County Telephone Company has increased its capital stock to $25,000. The company has commenced work on its new telephone building in this city.

CHICAGO, ILL.—The capital stock of the Chicago & Southern Traction Company has been increased from $2,000,000 to $5,000,000.

DUQUOIN, ILL.—An announcement has been made by the Duquoin, Belleville & St. Louis Electric Railway Company that all preliminary details pertaining to the construction of the interurban railway from Zeigler to Bellevue and St. Louis, via Bento and Duquoin, have been completed. Bonds to the amount of $2,000,000 have been issued and placed with the Carnegie Trust Company, of New York, N. Y. The newly elected officers of the company are: William R. Hayes, president; Thomas H. Davidson, vice-president; Thomas J. Howell, secretary; Harry E. Ross, treasurer, and J. Henry Ward, general manager.

PEORIA, ILL.—The Board of Supervisors is considering the installing of an electric light plant at the county farm.

POLO, ILL.—The capital stock of the Polo Mutual Telephone Company has been increased from $5,000 to $10,000.

SILVIS, ILL.—The Town Council has granted a franchise to the Moline, Rock Island & Eastern Railway to operate an electric railway on First Avenue through the town for a term of 50 years, in return for which the company is to furnish electric lamps along the avenue.

SPRINGFIELD, ILL.—James L. Adams, Jr., has completed plans and specifications for the central station of the new electric light company, to be erected on Madison and Fourth Streets, also plans for a conduit system on 20 blocks in the business section of the city.

WESTFIELD, ILL.—Mayor-elect M. L. Huey and the new City Council are said to be in favor of granting a franchise for an electric light plant.

WILLISVILLE, ILL.—At an election held recently the proposition to issue $8,000 in bonds for an electric light plant was defeated.

GREENFIELD, IND.—Mr. C. M. Korkpatrick, of this city, to whom was awarded the contract to install a heating and lighting plant in the court house and the jail, is in the market for material and equipment.

MUNCIE, IND.—The city has disposed of the machinery of the municipal electric light plant.

RUSHVILLE, IND.—The Rushville Co-operative Telephone Company has awarded a contract for the construction of a two-story exchange building to Morris Winship.

VINCENNES, IND.—The Vincennes Electric Company, incorporated under the laws of Michigan, has been admitted to Indiana to manufacture and sell electricity for light and power, and deal in appliances and equipment for the same. The company will establish a power station between Seminary and Hart Streets in Vincennes. A. J. Heitz is the Indiana agent. The officers are: Charles E. Moore, president, and W. H. Raignel, secretary.

ROFF, I. T.—At an election held here recently the citizens voted in favor of issuing $10,000 in bonds for an electric lighting plant.

CANTRIL, IA.—Walter Miller, city clerk, writes that E. E. McKee, of Cantril, is engineer for the proposed electric light plant.

MANCHESTER, IA.—The Delaware County Telephone Company is contemplating placing its wires underground in the business section of the city.

COFFEYVILLE, KAN.—The Kansas Traction Company has just been capitalized for $25,000. The company proposes to build an electric railway from Coffeyville to Kansas City, a distance of 260 miles.

GIRARD, KAN.—A franchise has been granted by the Board of County Commissioners to the Girard Coal Belt Electric Company to build an electric railway along the county roads from Dunkirk to Mulberry.

LEAVENWORTH, KAN.—C. F. Holmes, president of the Kansas City Western Railway Company, announces that the new power house of the road will be located at Leavenworth, on the site given the company by the city. Contracts have been let for the machinery. The power house is to replace the one which was destroyed by fire last summer at Wolcott, Kan.

NEWTON, KAN.—The Gas & Electric Company, of Newton, has changed its name to the Electric Light & Power Company. The company is installing a Cooper Corliss engine, a three-phase generating unit of 150 kilowatt capacity and a high-pressure boiler. James D. Nicholson is secretary and manager.

VERSAILLES, KY.—The Versailles Electric Light Company has sold its electric light plant here to Harry Reid, formerly of New York.

HOUMA, LA.—C. H. Jenks, of Fayette, Miss., has been selected to supervise the construction of a municipal electric light plant at Houma.

BINGHAM, ME.—The Bingham Electrical Company has been incorporated, with a capital of $25,000, to generate and sell electricity for heating, lighting, power and manufacturing purposes in Bingham, Moscow and Concord and Pleasant Ridge Plantation. Albert F. Webster is president and Roy M. Savage secretary, both of Bingham.

WESTBROOK, ME.—Plans are now being made for the construction of the new power house of the Westbrook Electric & Power Company, on which work will soon commence. The Farnham Construction Company will have charge of the work.

BALTIMORE, MD.—The work of electrifying the Baltimore & Annapolis Short Line Railroad will soon begin. J. G. White & Company will have charge of the work. The road is now part of the Maryland Electric Railway system.

BALTIMORE, MD.—The Electrical Commission has decided to notify all corporations having wires strung on poles in the district bounded by Pratt, Eutaw, and Henrietta Streets and Fremont Avenue to place their wires in underground conduits within five months from May 1.

FREDERICK, MD.—The Frederick & Middletown Railroad Company has purchased a site on East Patrick Street, on which it will erect a large power house.

TAKOMA PARK, MD.—The Town Council has granted a permit to the Potomac Electric Power Company to erect a pole line on Carroll Avenue for the purpose of furnishing electricity for light and power for the buildings of the Washington Sanitarium.

ASHBURNHAM, MASS.—Henry Allison and Andrew Whitney have purchased the plant, holdings and franchises of the Green Electric Light, Power & Manufacturing Company, of this place.

BOSTON, MASS.—The Boston Electric Railway Company is contemplating the issue of $5,800,000 in bonds and $8,000,000 in stock for the purpose of taking up floating indebtedness and for improvements and construction purposes.

LOWELL, MASS.—The contract for the power plant of the Hamilton Manufacturing Company has been awarded to Westinghouse, Church, Kerr & Company, of New York, N. Y.

MALDEN, MASS.—The Malden Electric Company is planning to install a steam turbo-generator set and new boilers in its plant.

MARBLEHEAD, MASS.—Plans are now under consideration for the installation of a new boiler in the municipal electric lighting plant, for which the contract will soon be awarded.

NORTH ADAMS, MASS.—Plans are being made by the James E. Hunter Machine Company to operate the machinery in its plant by electric motors.

SHELBURNE FALLS, MASS.—The bill authorizing the Shelburne Falls & Colrain Street Railway Company to extend its lines into the town of Buckland has been approved by the Legislature.

SPRINGFIELD, MASS.—Bids will be received until May 9 by the committee on city property for furnishing electric light fixtures for Armory Street School addition. A. F. N. Pillsbury is chairman.

SPRINGFIELD, MASS.—Work will soon commence on the construction of the addition to the car shops in West Springfield of the Boston & Albany Railroad and the installation of machinery for the substitution of electricity for steam power throughout the entire plant, for which an appropriation of $300,000 was recently made by the company. It is understood that the Westinghouse, Church, Kerr Company will have charge of the work.

TURNERS FALLS, MASS.—The Franklin Electric Light Company is arranging to install a high-tension wire to Amherst and Millers Falls for street lighting purposes. The Selectmen recently granted a charter to the Connecticut Valley Power Company to erect poles in certain streets, which would indicate that electricity for street lighting in Amherst is to come from the Turners Falls Power Company. It is understood that the Greenfield Electric Light & Power Company is also planning to secure electric energy from the same source.

GRAND RAPIDS, MICH.—The Grand Rapids-Muskegon Power Company has applied to the City Council for a franchise to furnish electricity in this city.

LANSING, MICH.—The City Council has granted the amended franchise to the Citizens' Telephone Company and the work of improvement will be taken up soon. The company is planning an expenditure of $125,000, which will include the construction of a new exchange building and other improvements.

BEMIDJI, MINN.—The Beltrami Electric Light & Power Company is constructing a large dam and power house at the rapids in the Mississippi River, five miles east of Lake Bemidji, for the purpose of furnishing electrical power for operating the Bemidji electric light plant and other manufacturing industries of this city. The company has secured the right of way for its transmission lines from the power house to the city.

DAWSON, MINN.—Bids will be received until May 11 by President Jas. O'Hara, village council, for $12.000 in bonds to be issued for the purpose of constructing an electric light plant.

MARSHALL, MINN.—Engineer Hugo has recommended the construction of an electric light plant, at a cost of $17,000.

MINNEAPOLIS, MINN.—The Minneapolis, Rochester & Dubuque Traction Company has applied to the commissioners of Hennepin County for a franchise to construct its line along the county roads from the city limits and extending to the Minnesota River at Savage.

ST. PAUL, MINN.—The Senate has appropriated $25,000 for a power and lighting plant at the State Fair Grounds.

ST. PAUL, MINN.—Work has commenced on the construction of a new electrical power house for the St. Anthony Falls Water Power Company on the east bank of the Mississippi River at Minneapolis, near the site of the old east side pumping station.

TWIN VALLEY, MINN.—J. F. Heiberg has been granted a franchise for an electric light plant.

WESTBROOK, MINN.—Bert Milligan, chief engineer of the electric light plant proposed by K. Krueger, writes that nothing definite has yet been done. The plant may not be installed this summer.

BROOKHAVEN, MISS.—The 13-ft. flywheel at the city lighting plant burst on April 16, damaging the plant to the extent of $1,000. New machinery, recently ordered, has not yet been installed in the plant.

PASS CHRISTIAN, MISS.—The City Council is considering the question of establishing a municipal electric light plant.

KANSAS CITY, MO.—Work has resumed on the construction of the Kansas City & Olathe Electric Railway. A site for the power house has been chosen at Shawnee. The company is planning to have its line in operation by October.

MEMPHIS, MO.—The Iowa-Missouri Traction & Power Company has made a mortgage to the Knickerbocker Trust Company, of New York, as trustee, to secure an issue of $1,000,000 in bonds. H. Blackledge is president and John H. Watkins, secretary. W. C. Picking, of Memphis, is also interested in the company, which proposes to construct an interurban railway from Fairfield, Ia., to Memphis, Mo., and a southern extension from Memphis to Mexico, Mo.; also a northern extension from Fairfield to Cedar Rapids, Ia. The distance now ready for construction is 52 miles.

ST. JOSEPH, MO.—W. E. Spratt, Mayor, in his annual message recommends a new boiler for the municipal electric light plant and additional lamps.

CHOUTEAU, MONT.—The Montana Telephone Company, of Chouteau, has increased its capital stock from $2,400 to $25,000.

BEATRICE, NEB.—The Beatrice Gas & Power Company is contemplating an expenditure of about $40,000 in improvements to its plants.

FRIEND, NEB.—A. H. Frantz, city clerk, writes that contracts for constructing an electric light plant have been awarded as follows: Pole line connection, to Northwestern Electric Equipment Company, of St. Paul, Minn., for $6,629; engine and boiler, Sunderland Roofing & Supply Company, Omaha, $4,557; and generator, series arc equipment and transformers to Western Electric Company, Kansas City, Mo., $3,165.

RENO, NEV.—Walter Harris and J. E. Gignoux have applied to the City Council for a franchise to operate an electric railway on several streets in the city.

YERINGTON, NEV.—Plans and specifications have been prepared for the 1,000-ton electro-magnetic separating plant for the Bluestone Company, which will soon be installed in the smelter plant of the company.

CAMDEN, N. J.—Before taking action upon a proposed bond issue for the purpose of establishing a municipal lighting plant, members of the finance committee of Camden City Council instructed the city controller and city counsel to call upon the officers of the Public Service Corporation and ascertain from them, if possible, what it would cost for lighting the city after the expiration of the present contract. They were also instructed to ascertain what concessions would be made for the balance of the time the contract is to run. While the city voted to run the lighting plant, some members of the City Council are of the opinion that better results can be obtained through private ownership.

LONG BRANCH, N. J.—H. C. Newton, manager of the local branch of S. Edward Eaton & Company, electricians, has been awarded the

contract to install electric work in the new Hotel Takanassee. The building will be supplied with a private dynamo, electric elevators and over 1000 incandescent lamps.

NEWARK, N. J.—The special committee on municipal lighting of Common Council on April 23 approved the report of its engineer, Fred. O. Runyon, that a municipal electric light plant operated by steam be installed at the Belleville pumping station, and decided to recommend that Council adopt the resolution providing for the calling of a special election to vote on the question of expending $1,000,000 for the construction of such a plant.

ALBANY, N. Y.—Plans are being made by the engineering department of the New York Central Lines for an 80-ft. extension to the West Albany power station, which, when completed, will cost over $150,000.

ALBANY, N. Y.—The United Traction Company has been granted permission by the State Railroad Commission to issue $500,000 bonds on its consolidated mortage for $6,500,000, which was authorized in 1905. The proceeds of the sale of the $500,000 bonds will be applied to the company's improvements now under way. The company has also contracted for new converters and transformers at a cost of $8,600.

BATH, N. Y.—The only bid recently received for lighting the village streets at the expiration of the present contract in September was that of the Bath Electric Light Company, which the Village Trustees are stated to have rejected. New bids will be called for.

CATSKILL, N. Y.—Application has been made by the Catskill Illuminating & Power Company to the State Commission on Gas and Electricity for permission to lease all of its property and franchises to the Schoharie Light & Power Company.

FREWSBURG, N. Y.—The State Commission on Gas and Electricity has granted a certificate of authority to the Frewsburg Electric Light & Power Company to transact business and permission to increase its capital stock from $3,000 to $12,000.

FULTON, N. Y.—The State Gas and Electric Commission has granted the Fulton Light, Heat & Power Company permission to increase its capital stock from $150,000 to $215,000.

KINGSTON, N. Y.—The Ulster Lake Company has applied to the State Commission on Gas and Electricity for a certificate of authority to transact business in the towns of Warwarsing and Rochester, and the village of Ellenville, in Ulster County, and in the towns of Mamakating, Fallsburgh, Liberty and Monticello in the County of Sullivan, and for consent to increase its capital stock from $2,000 to $25,000.

LOCKPORT, N. Y.—The Economy Light, Fuel & Power Company has applied to the State Gas & Electric Commission for permission to mortgage its property for $250,000 and to issue $185,000 in bonds.

OSWEGO, N. Y.—J. A. Culkin has secured the contract for the construction of the power house for the new electrical plant of the Corn Products Company. The structure will cost about $10,000.

POTSDAM, N. Y.—The citizens of this village are considering the proposition of establishing and maintaining a municipal electric lighting plant.

SALAMANCA, N. Y.—The Village Board has granted the application of the Western New York & Pennsylvania Traction Company for a franchise to construct and operate an electric railway on certain streets in the village.

WAVERLY, N. Y.—The State Commission on Gas and Electricity has denied the application of the Waverly Electric Light & Power Company to lease its property, rights and franchises to the Sayre Electric Company.

WAYLAND, N. Y.—The Rochester & Southern Construction Company has decided to locate the power house here.

WILLIAMSON, N. Y.—The Sodus Gas & Electric Light Company, of Sodus, has submitted a proposition to this village offering to extend its lines to the village if sufficient business can be obtained.

ELIZABETH CITY, N. C.—The Elizabeth City Electric Light & Power Company is installing 40 new arc lamps for street lighting purposes.

ATHENS, OHIO.—The Board of Trustees of Public Affairs is advertising for bids for one 125-hp high-speed engine, one 75-kw alternating-current generator, 50 light transformers, regulator addition to switchboard, series arc lamps and pole line supplies. A. T. Bell is superintendent.

BERLIN, OHIO.—The Berlin Telephone Company has increased its capital stock from $4,050 to $25,000.

CINCINNATI, OHIO.—Surveys are now being made by the Cincinnati, Reading & Middletown Traction Company with a view of securing a private right of way for the entire distance of its proposed road. Applications will soon be made to the county commissioners for concessions along the county roads.

CLEVELAND, OHIO.—The Cleveland, Southwestern & Columbus Railway Company has filed with the Cleveland Trust Company, as trustee, its new mortgage securing $10,000,000 in bonds.

CLEVELAND, OHIO.—J. J. Breitinger, president of the Cleveland, Brooklyn & Elyria Traction Company, states that plans are being made for the construction of an electric road to connect Barberton and Orrville, by the way of Doylestown. The new road is to be known as the Barberton, Doylestown & Orrville Railway. It is said that the road has been financed and that construction work will start soon.

COLUMBUS, OHIO.—Superintendent Reid, of the municipal lighting plant, has modified the specifications for the new turbo-generator to be purchased by eliminating the requirement of steel blades, in order that the bid of the Allis-Chalmers Company may be considered.

COLUMBUS, OHIO.—The capital stock of the Columbus Citizens' Telephone Company has been increased from $1,250,000 to $1,750,000. Provision has been made to issue $250,000 of the stock at once, the remainder to be held in the treasury until needed.

COLUMBUS, OHIO.—Bids will be received at the office of the secretary of the State Sanatorium Commissioners until May 14, for furnishing the materials and labor for the construction of the power house for the Ohio State Sanatorium. C. O. Probst, M.D., is secretary.

FOSTORIA, OHIO.—Official announcement has been made that the Toledo, Fostoria & Findlay Electric Railway Company is to extend its line from Pemberville to Toledo. J. E. Reeves is president of the Company.

MEDINA, OHIO.—The Medina Telephone Company has increased its capital stock from $35,000 to $44,500.

ST. BERNARD, OHIO.—Bids will be received at the office of the clerk for the purchase of $6,500 in bonds, issued for the purpose of improving and repairing the water works and electric lighting plant. George Schroeder is clerk.

SARDINIA, OHIO.—The capital stock of the People's Telephone Company has been increased from $5,000 to $15,000.

THURSTON, OHIO.—The stockholders of the Buckeye Lake Home Telephone Company have decided to increase the capital stock of the company from $10,000 to $30,000.

TOLEDO, OHIO.—The Central Heating & Light Company has petitioned the City Council for a franchise in that portion of the business district bounded by Washington, Eleventh, Jackson and Superior Streets. C. S. Ashley is one of the chief promoters.

TOLEDO, OHIO.—The Toledo & Indiana Railway Company is contemplating the construction of an extension of its lines from Bryan to connect with the St. Joe Valley line for a through route from Toledo to Fort Wayne.

TOLEDO, OHIO.—The Riggs & Sherman Company has been engaged to lay out routes for two proposed interurban railways in Ohio, one to extend from St. Clairville, Ohio, to Wheeling, W. Va., and the other is the Minster, Loramie & Southern, which is to be a 45-mile extension of the Western Ohio Railway, and is to run from Greenville to Piqua. The first-named road is to be known as the Belmont Electric Railway.

OKLAHOMA CITY, OKLA.—John W. Shartel, general manager of the Oklahoma City Railway Company, has announced that the appropriations made by the board of directors for improvements, extensions and equipment to the local street railway system for the current year amounted to $665,500. Several miles of extensions will be built during the next few months.

NEWBURG, ORE.—H. A. Grafe, of the Newburg Flouring Mills, is contemplating installing an electric motor to operate the mills during the low water period. The steam plant will be discarded.

PORTLAND, ORE.—The Portland Railway Company has purchased a site on Northern Hill, on which it will erect a sub-station.

BLOOMSBURG, PA.—Officials of the Columbia & Montour Electric Railway have planned extensive improvements, including the doubling of the capacity of the sub-station at Willow Grove.

COLUMBIA, PA.—The Columbia & Manor Street Railway Company has decided to increase its capital stock from $102,000 to $225,000.

ELIZABETHTOWN, PA.—The Elizabethtown & Deodate Street Railway Company will make application to the Governor, April 29, for a charter to build a line from Elizabethtown to Hockersville, a distance of about 10 miles. The incorporators are: William H. Lebkicher, of Hershey; John E. Snyder, of Lancaster; S. C. Strehr, of Hummelstown; C. S. Maulfair, of Annville, and E. B. Snavely, of Hershey.

ERIE, PA.—It is reported that F. F. Curtze has secured an option of the entire holdings of the Erie & Cambridge Springs Electric Railway. It is also stated that extensive improvements will be made to the system when Mr. Curtze obtains control of the road. New cars will be ordered and the capacity of the power plant will be increased at once.

INDIANA, PA.—The Indiana County Railways Company is in the market for the following equipment: Three generators, four boilers of 500 horse-power each; two turbines, and one simple engine. During the coming year contracts will be let for the construction of a power station and 25 miles of track.

LANCASTER, PA.—The directors of the Lancaster County Railway & Light Company are arranging to install in the power plant at Engleside the machinery necessary for increasing the capacity of that plant by 1500 horse-power. The machinery required will include an engine and generator. The company is planning several extensions to its lines.

NAZARETH, PA.—It has been decided to build an electric railway between this place and Bath to furnish transportation for the employees of the cement works between the two places. Most of the right of way has been secured. Conrad Miller, of Nazareth, will be president of the company.

NORRISTOWN, PA.—A contract will soon be let for the construction and equipment of the Lederachville & Lewisburg Electric Railway, which is controlled by the Montgomery County Rapid Transit Company. The road will be 15 miles long. For the present the company will secure electricity for operating the road from the Schuylkill Valley Traction Company. The Montgomery County Rapid Transit Company is contemplating an extention from Norristown to Philadelphia. W. C. Riffer is secretary and treasurer.

PHILIPSBURG, PA.—Surveys are now being made for the extension of the Philipsburg Electric Railway to Osceola.

PHOENIXVILLE, PA.—The Philadelphia Interurban Railway Company has applied to the Town Council for a franchise to build an electric railway over certain streets of the town.

PITTSBURG, PA.—Plans and specifications are about complete for the new Brownsville line of the West Penn Railways, between Orient and Brownsville. Contracts for the work will be let within two weeks.

SOUDERTON, PA.—The Town Council is considering the proposition of abandoning the borough electric light plant and purchasing electricity to operate the borough lighting system. The West Telford Electric Company has offered to furnish electric energy at a lower price than the borough can manufacture it.

TITUSVILLE, PA.—The Titusville Traction Company has decided to extend its lines to Cambridge Springs and to Oil City.

WILKES-BARRE, PA.—Two companies have applied to the City Council for franchises to furnish electricity for lighting various streets of the city. One company is known as the Subway Electric Company and the other as the Anthracite Company.

LAURENS, S. C.—C. R. Willard & Son, of Spartanburg, have secured the contract for constructing a dam for the Reedy River Power Company to be completed by December, when it is expected to have the system complete for the transmission of power to Laurens.

CHATTANOOGA, TENN.—Plans have been completed by the Chattanooga Electric Company for improvements to its power plant, which will increase the capacity of the plant by over 1500 horse-power. A new boiler house will be erected, in which will be installed four new water tube boilers with a capacity of 408 horse-power each. Another 1000-kw turbo-generator set will also be installed at the plant. The company has made arrangements to supply the new plant of the American Brake Shoe & Foundry Company with 350 horse-power, and also to furnish 750 horse-power additional to the Chattanooga Railways Company for the street railway system. The company is making a special effort to secure contracts to furnish electrical energy for motors. The company will expend about $140,000 in improvements.

NASHVILLE, TENN.—The Tennessee Legislature has recently passed a bill authorizing the city of Nashville to issue $275,000 in bonds to extend the lighting plant.

NASHVILLE, TENN.—The proposed electric railway from this city to the proposed site of the White City will be built by S. P. Condon, of Knoxville. Charles Kuhn, of Buena Vista Springs, is promoter of the line. The road will be about two miles long and will cost about $125,000.

BOWIE, TEX.—The Bowie Light & Power Company has sold its plant to Wright Brothers & Simpson, of Newport.

CLARENDON, TEX.—Extensive improvements are being made to the local telephone system, which, when completed, will cost about $15,000.

GOLDTHWAITE, TEX.—The City Council has granted Geeslin & Company an electric light and power franchise in this city. The company will commence at once the construction of a plant, and will also operate an ice plant in connection with the lighting plant.

MONTPELIER, VT.—The Vermont Power & Lighting Company has executed a trust deed to the Trust Company of America, of New York, N. Y., as trustee, to secure an issue of $500,000 in bonds.

ST. ALBANS, VT.—The Vermont Power & Manufacturing Company is contemplating extending its lines to Cambridge and Jeffersonville. Frank H. Foote is superintendent.

RICHMOND, VA.—The Board of Aldermen has adopted a resolution calling on the finance committee to inquire into the advisability of submitting to the people the question of issuing bonds for enlarging the water works and establishing an electric light plant.

ABERDEEN, WASH.—Preparations are being made for the construction of the new power plant at the Gray's Harbor Railway & Light Company. The plant will furnish electricity for lighting and power in this city and Hoquiam. The cost is estimated at $250,000.

ATHENS, WIS.—The Athens Telephone Company has filed an amendment to its charter increasing its capital stock from $750 to $6,000.

GRAND RAPIDS, WIS.—O. T. Haugen, of Grand Rapids, is secretary of a company which proposes constructing a dam at St. Augusta. Nothing definite has yet been done. Jacobson & De Guere, of Grand Rapids, are the engineers.

MILWAUKEE, WIS.—The capital stock of the Automatic Telephone Company has been reduced from $50,000 to $5,000.

MILWAUKEE, WIS.—The Milwaukee Telephone Company has changed its name to the Milwaukee Independent Telephone Company.

REEDSVILLE, WIS.—Bids will be received by Chas. Heim, village clerk, until May 9 for one 45-kw direct-current generator and switchboard, 31,548 ft. copper wire, 10 arc lamps, two 30-hp producer gas engines, one 60-hp suction gas producer, one 300-gal. triplex pump, construction of two miles of pole line, together with shafting, friction clutch pulleys and floor stands. W. Y. Kirchoff, of Madison, Wis., is engineer.

SUPERIOR, WIS.—This city contemplates building a municipal electric light and power plant of about 1000 horse-power capacity. Plans and specifications will be completed about May 20. Owen Ford, St. Louis, Mo., is consulting and supervising engineer.

BATTLEFORD, CAN.—Sealed tenders will be received by R. C. Laurie until May 10 for the installation of a complete electric lighting system. Plans and specifications may be seen at the office of Galt & Smith, consulting engineers, Toronto, and also at the civic offices, Battleford, Sask.

CALGARY, CAN.—The ratepayers on April 25 passed a by-law to raise $250,000 to construct a municipal street railway.

CALGARY, CAN.—The Council is preparing a by-law to raise $250,000 for the construction of a civic telephone system. Address, Mayor Cameron.

CALGARY, CAN.—The Alberta Portland Cement Company will develop 5000 electrical horse-power and will sell electricity for power and light in a portion of the city, retaining 2000 horse-power for its own use.

COLD SPRINGS, CAN.—The Hamilton Township Rural Telephone Company has been incorporated, with a capital stock of $10,000.

WINNIPEG, MAN.—The Bell Telephone Company has taken out a permit for the construction of an exchange building at the corner of Corydon and John Streets, to cost $38,000.

HAMILTON, ONT.—The City Council on April 22 ratified the application made by the Board of Public Works to the Hydro-Electric Power Commission, asking it to furnish a statement of the terms for 3000 horse-power, the price not to exceed $17.50 per horse-power per year. The application also requests the commission to give the city an estimate of the cost of installing a street lighting plant. It is the intention of the Board of Public Works to call for prices on street lighting before erecting a city plant.

TORONTO, ONT.—The Hydro-Electric Commission has received application for 29,650 horse-power from eight municipalities as follows: Toronto, 15,000 horse-power; London, 6000 horse-power; Brantford, 2500 horse-power; Guelph, 2000 horse-power; Galt, 1200 horse-power; Woodstock, 1200 horse-power; Berlin, 1000 horse-power, and St. Marys, 750 horse-power. In connection with the distribution of this power a plant will be erected at Toronto at a cost of $1,500,000 and smaller plants will be erected at the other towns.

WINDSOR, ONT.—The Windsor, Essex & Lake Shore Electric Railway Company has purchased a private right of way to Leamington, and it is expected that work will shortly begin on the construction of the road.

INDIAN HEAD, SASK.—O. J. Godfrey, town clerk, writes that the Council is submitting by-laws to the ratepayers providing for $50,000, to be used for extensions to water works, electric light plant and other public improvements. He further states that a good deal of the work will be done by the city. No date has yet been set for the letting of contracts.

Company Elections.

FORT SMITH, ARK.—At a recent meeting of the Fort Smith Light & Traction Company the present board of directors was unanimously re-elected. A. S. Huey was re-elected president; H. M. Byllesby, vice-president, and James Brizzolara, secretary.

DENVER, COL.—At the annual meeting of the Northern Colorado Power Company, held April 6, the officers were re-elected as follows: W. J. Baker, president; N. A. Clark, vice-president and general manager; George Best, secretary; Thomas Keely, treasurer. The company expects to have its large plant at Lafayette completed by June 1, which will enable the company to discontinue the smaller plants in other towns.

CAMDEN, N. J.—At the annual meeting of the stockholders of the Electric Company of America, held April 23, the following directors were elected: Colonel A. Louden Snowden, John H. Catherine, Samuel Gustine Thompson, George A. Cotton, Frederick M. Walton, George Brinton Roberts, H. T. Hartman, H. S. Kerbaugh and James E. Hayes.

ITHACA, N. Y.—At a meeting of the directors of the Cayuga Southern Telephone Company held April 24 the following officers were elected: Samuel Jeffrey, president; Isaac P. Hazard, Sr., R. B. Fegan, secretary; G. W. Jeffrey, treasurer; executive committee, Samuel Jeffrey, R. B. Fegan and Isaac P. Hazard, Jr.

UTICA, N. Y.—At a meeting of the directors of the Utica Gas & Electric Company held recently the following officers were elected: Anthony N. Brady, president; William E. Lewis, treasurer; J. Jesse Brayton, secretary, and William J. McSorley, auditor.

New Industrial Companies.

THE AMERICAN ELECTRIC FURNACE COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $10,000. The directors are: J. M. Clark, W. H. Mills and J. A. Rawlins, of New York City.

THE CITY HEATING & ELECTRIC COMPANY, of Terre Haute, Ind., has incorporated for the purpose of manufacturing and installing heating and electric light plants; also to carry on a general supply business. Lester W. Watson is president and Victor Peterson secretary.

THE NELTUR ELECTRICAL COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $1,000, by E. W. McGuire, H. R. Smith, of New York, N. Y.; Wilhelmina J. Schubert, of North Hackensack, N. J.

THE H. M. SHAW & COMPANY (electrical engineers), of East Orange, N. J., has been incorporated, with a capital stock of $10,000, by James Shunks, John S. Jackson and William C. Carpenter.

THE UNITED ELECTRIC COMPANY, of Lockport, N. Y., has been organized by W. C. Winchester, formerly general superintendent of the Economy Light, Fuel & Power Company, and F. G. Stone. The company has purchased the business of the United Electric Company and will continue it at the same place. The new company has a contract to do all of the electrical work for the Economy Company.

New Incorporations.

BIRMINGHAM, ALA.—The Warrior River Power & Electric Company has been incorporated for the purpose of developing the water power of the Warrior River and building an electric freight and passenger railway from Huntsville to Birmingham, Ala., a distance of 100 miles. The officers of the company are: M. C. McGannon, Nashville Tenn., president; Albert Hudson, Nashville, vice-president; Edgar O. McCord, Albertville, Ala., secretary and treasurer.

BEARDSTOWN, ILL.—Articles of incorporation have been filed with the Secretary of State for the Clay City Electric Light & Power Company, with a capital stock of $12,000. The incorporators are H. M. Schmoldt, Theodore Fisher and Clifford Garm.

CARLYLE, ILL.—A certificate of incorporation has been issued to the Carlyle & St. Louis Railway Company. The company has a capital stock of $5,000. T. E. Ford, of Carlyle, is interested in the project.

CHICAGO, ILL.—Articles of incorporation have been filed for the Chicago, Ottawa & Peoria Railway Company, with a capital stock of $50,000. The incorporators are: H. E. Chubbuck, of Ottawa, G. A. Wright and others.

HENDERSON, KY.—The Henderson Traction Company has been organized, with a capital of $150,000. The officers of the company are: Henry P. Barrett, president; J. Henry Lyne, vice-president; Charles E. Dallam, secretary and treasurer. The company has filed a deed of trust to the Ohio Valley Banking & Trust Company, of this city, for $150,000 to be floated on the property, $95,000 to be used to pay for the street railway plant and $45,000 for extensions to the system.

SEARSPORT, ME.—The Searsport Electric Company has been incorporated with a capital stock of $50,000 by A. J. Nickerson and others.

NEW BEDFORD, MASS.—The Shore Line Street Railway Company has been formed, with a capital stock of $75,000, to build and operate a street car line to Horse Neck Beach and Westport Point. The road will be 13 miles long. The directors are: Charles F. Parker, of Woonsocket, R. I.; A. C. Ralph, of Taunton; Andrew H. Sowle, of Westport; B. W. Gleason, of Boston; J. M. Shorrocks, of Westport; Jeffers F. Richardson, of Albany, N. Y., and N. L. Sheldon, of Boston.

KANSAS CITY, MO.—The Blue Valley Railway Company has been granted a charter by the Secretary of State, with a capital stock of $100,000. The incorporators are: Alexander Massey, Edwin L. Brown, Joseph S. Chick, Jr., Willard E. Winner, of Kansas City, and John Georgen, of Independence.

PLYMOUTH, N. H.—The White Mountain Telephone & Telegraph Company has been chartered, with a capital stock of $100,000. The company has absorbed the Plymouth & Campton Telephone Exchange Company, the Pike Telephone Company, the Franconia Telephone Company, the Bradford, Vt., exchange of the New England Telephone Company and other minor lines of the New England Company in that section of Vermont. The officers of the new company are: Allen Hollis, of Concord, president; Davis B. Keniston, of Plymouth, treasurer, and Walter I. Lee, general manager.

AUSABLE FORKS, N. Y.—The Lake Champlain & Lake Placid Traction Company has filed articles of incorporation with the Secretary of State for the purpose of constructing and operating an electric railway from Westport to Lake Placid and also to Ausable Forks. The capital stock is $1,500,000, and the directors are: Albert L. Washburn, Norman C. Spencer, Wilbur T. Halliday, Elizur S. Goodrich and Henry F. Smith, of Hartford, Conn.; George S. Raley, William L. Kiley and Thomas D. Trumbull, of Glens Falls, N. Y., and Richard L. Trumbull, of Ausable Forks, N. Y.

EATON, OHIO.—The Eaton Gas & Electric Company has been incorporated with a capital stock of $200,000 by A. H. Wyatt, W. W. Tait, George Hoyt, W. W. Hoyt and N. B. Martin.

FINDLAY, OHIO.—The Findlay-Marion Railway & Light Company has been organized with the following-named officers: R. P. Hankey, of Detroit, Mich., president; G. W. Meeker, of Columbus, secretary and treasurer. The company is capitalized at $250,000 and will construct an electric railway from Findlay to Marion, a distance of about 47 miles.

YOUNGSTOWN, OHIO.—The Lake Erie & Youngstown Railroad Company has been incorporated for the purpose of building an electric railway between this city and Conneaut.

DENTON, TEX.—Articles of incorporation have been filed for the Denton Interurban Railway & Power Company by H. Griffin, R. J. Wilson, W. W. Wilson and others. The capital stock of the company is $100,000.

HOUSTON, TEX.—Articles of incorporation have been filed with the Secretary of State for the Houston-Galveston Electric Railway Company. The directors are: M. M. Phinney, of Dallas; David Daly, C. W. Wharton, W. B. Chew, Jesse H. Jones, William A. Wilson and James A. Baker, Jr., all of Houston.

Legal.

CONTRACT OF DIRECTORS OF CORPORATION BINDING UPON CORPORATION.—In an action against a corporation to recover the purchase price of an air compressor sold and delivered to the promoters of the company, who were also the company's directors, it was claimed by way of defense that such a contract could not be ratified, so as to make the corporation liable thereon, unless the particular knowledge of all the material facts came to the directors at a regular meeting of the board. It was held that, inasmuch as a majority of the directors of the corporation had knowledge of the material facts with reference to the purchase of the compressor and promised to pay therefor, and as the company had made use of the compressor, the company was liable upon the contract, although there had been no formal ratification of the contract at a regular meeting of the board of directors. Possell vs. Smith, Supreme Court of Colorado, 88 Pac. Rep. 1064.

Educational.

UNIVERSITY OF ILLINOIS.—The Engineering Experiment Station of the University of Illinois has recently issued Bulletin No. 9, "An Extension of the Dewey Decimal System of Classification Applied to the Engineering Industries." This bulletin is in effect a fifth edition of the extension previously issued by the Mechanical Engineering Department. It contains the extensions previously worked out for mechanical and railway engineering and, in addition, a very complete extension for electrical engineering, and more or less complete extensions for bridge engineering, sanitary engineering, metallurgy and architecture. An alphabetical index of subjects adds to the usefulness of the classifications. The decimal system of classifications devised by Mr. Melvil Dewey was intended primarily for the use of librarians in classifying and arranging books and pamphlets. It has, however, been used extensively by engineers, manufacturers and business concerns for indexing technical data of all kinds, catalogues, reports, drawings, etc. Bulletin No. 9 extends the work of Dr. Dewey to practically all fields of engineering industry and presents a system of classifications of great value to engineers and those engaged in engineering industries. Copies may be secured by application to the director of the Engineering Experiment Station, Urbana, Ill.

SUMMER SCHOOL FOR ARTISANS.—The seventh annual session of the Summer School for Artisans held under the direction of the College of Engineering of the University of Wisconsin begins June 24 and continues for a period of six weeks. Courses of study are offered in the following subjects: 1, engines and boilers; 2, applied electricity; 3, mechanical drawing and machine design; 4, materials of construction, fuels and lubricants; 5, shop work; 6, manual training. The entire laboratory and shop equipment belonging to the College of Engineering is used by the students in the summer school. The requirements for admission do not extend beyond a working knowledge of English and arithmetic, but the policy is to allow a large amount of individual work so that the student may take advantage of all the preparation he has obtained. This school offers to those unable to take a regular four years' course an opportunity of obtaining a working knowledge of the methods of testing and the use of instruments, together with such theoretical principles in each case as the nature of the subject and the preparation of the student may permit. Correspondence students have found this school of value in giving an opportunity for laboratory practice along the lines in which they have had theoretical instruction. A bulletin describing the work of the School for Artisans in detail will be sent on application to Frederick E. Turneaure, Dean, College of Engineering, Madison, Wis.

Obituary.

MR. A. F. HARROLD.—We regret to note the death at Barrington, R. I., on April 18, of Mr. Anson F. Harrold, 38 years old, president of the American Transformer Company, of Newark, N. J., and formerly a well-known football player. He died of tuberculosis of the throat. He was a tackle on the Princeton football team 15 years ago. He leaves a widow and daughter.

GOV. R. B. BULLOCK.—The death of an old-time telegrapher, ex-Gov. Rufus B. Bullock, of Georgia, occurred at Albion, N. Y., on April 27. He was born in Bethlehem, N. Y., on March 28, 1834. At the age of 16 he was graduated from the then celebrated Albion Academy. After his graduation he mastered the House printing system of telegraphy, and soon took a leading position as an expert in the class of operating. Several years before the outbreak of the Civil War Mr. Bullock was employed by the Adams Express Company to extend its business in the South. Although opposed to secession, he left the company's employ and gave his services to the Confederacy. He attained the rank

of lieutenant-colonel. After the war he resumed his position with the express company. Later he obtained a charter and organized the First National Bank in Augusta, and in 1867 was elected president of the Macon & Augusta Railroad. In 1868 he was elected Governor of Georgia. After a war with the politicians of the State, he resigned in 1870.

Personal.

MR. HARRY N. LATEY, who has just resigned as electrical engineer of the Interborough Rapid Transit Company, of New York, to enter the field of consulting and contracting engineering in partnership with Mr. F. R. Slater was the guest of honor at a banquet held at the Hotel Manhattan, in New York, on Friday evening, April 12. About 60 were present, including many of Mr. Latey's former associates in the Interborough Rapid Transit Company, Mr. George S. Rice and Mr. D. L. Turner, of the Rapid Transit Commission, and representatives of the prominent electric companies. Mr. H. G. Stott, superintendent of motive power of the Interborough Rapid Transit System, acted as toastmaster and portrayed in well chosen words the great regard and affection with which Mr. Latey is held by all those who have become acquainted with him, and he particularly pointed to his services in the field of New York rapid transit. Messrs. E. P. Bryan, president of the Interborough Rapid Transit Company; Frank Hedley, general manager of the Interborough Rapid Transit Company, and L. B. Stillwell, electrical director of the Interborough Rapid Transit Company, who were unable to be present sent letters of praise. Mr. Rice, chief engineer of the Rapid Transit Commission, stated that although Mr. Latey had resigned from the staff of the Interborough Rapid Transit Company, his connections are not entirely severed from the transportation companies of New York, as he, together with Mr. F. R. Slater, have been appointed consulting engineers of the Rapid Transit Commission. Other speakers were: Mr. S. L. F. Deyo, chief engineer of the Metropolitan-Interborough Company; Mr. George Pegram, chief engineer of the Interborough Rapid Transit Company; Mr. D. L. Turner, of the Rapid Transit Commission, and many others. Mr. Latey responded in a modest and sincere way to the many wishes for his success.

H. N. LATEY.

MR. FRANKLIN G. WATERS has been appointed superintendent of the municipal electric lighting plant at Jewett City, Conn., to succeed Mr. Maxcy Seymour, who has been acting in that capacity for the past two years.

MR. FARLEY OSGOOD, the well-known electrical engineer, has resigned as general manager of the New Milford (Conn.) Power Company, to take effect May 31. His plans for the future have not been announced.

COM. H. C. GEARING.—Commander Henry C. Gearing, who is in charge of the equipment department at the Mare Island Navy Yard, California, is preparing to go to Alaska this summer to inspect the new wireless stations which are to be installed there.

MR. CHARLES M. CRAWFORD, of Hartford, Conn., has been appointed chief engineer of the Cincinnati Northern Traction Company, of Hamilton, O., to succeed Mr. C. A. Alderman, who recently resigned to take a position with J. G. White & Company.

MR. F. W. ROEBLING, president of John A. Roebling's Sons Company, has become a member of the board of directors in the new National Copper Bank, which opened on May 1, at 115 Broadway, New York City, and has very influential support in metal and financial circles.

MR. W. W. TRACY has severed his connection as general manager of the Whitman Electric Railway & Power Company, of Colfax, Wash., and has entered the general electrical contracting business at Butte, Mont., where he will also maintain a manufacturers' agency, with offices at 1130 Utah Avenue.

MR. O. D. COLLINS, superintendent of the Home Gas & Electric Company, Redlands, Cal., has resigned to take the position as superintendent of the Redlands & Yucaipe Electric Railroad. Mr. F. P. Meserve has been appointed superintendent of the Home Gas & Electric Company to succeed Mr. Collins.

MR. TOMAS TORRES, who recently resigned as sub-director of the general post office in Mexico City, has been appointed general manager of the Compania de Tranvias, Fuerza y Luz de Guadalajara, which is taking over the street railway and lighting and power holdings of La Electra and the Compania Industrial de Guadalajara.

MR. W. R. JENNISON, Prudential Building, Atlanta, Ga., Southern representative for many years of the Lane & Bodley Company, Cincinnati, has severed his connection with Lane & Bodley, and will devote his attention exclusively to the sale of Wheeler condensers and Weber concrete steel stacks and Cochrane feed-water heaters and separators.

MR. T. A. EDISON and family have just returned home to Orange from their plantation in Florida, where they have spent several weeks. Mr. Edison put in some good time tarpon fishing and made several fine catches. A big tarpon caught by Mrs. Edison is being mounted by a taxidermist. Mr. Edison is much improved in health.

MR. R. C. HIGGINS, of Youngstown, O., inventor of a telephone standard for holding the receiver to the ear, is considering the organization of a company here to manufacture the appliance. It is of practical benefit, as both hands are left free to make notes while talking; or in case of long waits, it is unnecessary to sit at the telephone until answered.

MR. HORACE T. FRIZELLE, who was for several years connected with the purchasing department of the Colorado Fuel & Iron Company, Denver, Col., and for the past 10 years with the Bradstreet Company, New York City, has been appointed purchasing agent of the New York Engineering Company. After the 16th inst. he will be pleased to see his friends at the new offices of the company in the United States Express Building, 2 Rector Street, corner Trinity Place.

MR. ARTHUR WARREN, of Scarborough, Me., long and most favorably known in the field of daily journalism, technical journalism and technical publicity and advertising, has definitely entered the lecture field and has come before the public with a number of platform topics that draw for data and anecdote upon his newspaper experience with men and affairs. Mr. Warren is a finished and facile speaker, has an attractive voice and presence, and joins to great descriptive powers a subtle humor. He should go far in his new career.

MR. H. W. SAYLES, formerly electrical engineer for the Diamond Meter Company, and Mr. H. I. Waggoner, formerly with the Northwestern Electrical Equipment Company, have formed a company called the Electrical Testing Company, at Peoria, Ill., for the purpose of standardizing meters and instruments. They will also make competitive tests of meters for lighting companies. Mr. Sayles and Mr. Waggoner are both technical men and have had a numbers of years' experience in this class of work. Their office is at 922 South Adams Street.

MR. W. LOEB, JR.—It is stated from Washington that plans for the reorganization of the management of the Washington Railway & Electric Company, with William Loeb, Jr., secretary to the President, as its president, are being worked out. The date of Mr. Loeb's resignation and his assumption of these new duties, should present plans work out as expected, will be Jan. 1, 1908. Mr. Loeb has been secretary to the President since early in 1903, when he succeeded George B. Cortelyou, who then became Secretary of Commerce and Labor. Gen. G. H. Harris has for some time past been the active manager of the property.

MR. CHARLES W. FARR, founder and president of the Farr Telephone & Construction Supply Company, of Chicago, has resigned the presidency and managership of that company to become the president and manager of a new company, to be known as the Farr Electric Equipment Company, 170-172 West Adams Street, Chicago. The new company will do a general electric supply business, having already secured good agencies for different lines of electrical goods. This company will manufacture and put on the market the Farr electric deep sea sounding apparatus. The above-named companies are entirely separate and not connected in any way.

MR. F. V. L. SMITH is now connected with the Sprague Electric Company, of New York City, which he will represent in the South, with headquarters in New Orleans. Mr. Smith has had a wide experience in the electrical field, having been electrical inspector of the Pan-American Exposition in 1901, and afterward electrical inspector for the National Board of Fire Underwriters in New York City until December, 1904, when he became chief electrical inspector for the Louisiana Fire Prevention Bureau with headquarters in New Orleans. Owing to his extensive knowledge of electrical work and his acquaintance in the South, Mr. Smith is well fitted to represent the Sprague Electric Company in that section.

MR. JOHN BOTTOMLEY and Mrs. Bottomley celebrated at home in this city, on April 26, their twenty-fifth wedding anniversary, when large numbers of friends called to offer their congratulations and felicitations. Mr. Bottomley has long been a resident in New York, and is well known as a member of the bar, as well as in electrical circles. He is a nephew of Lord Kelvin, and is secretary to the Marconi Wireless Telegraph Company. Mr. Bottomley has long been interested in the development of Southampton, the fashionable summer resort on Long Island, and has a charming country residence at its new suburb, Water Mills, one of the prettiest spots at the eastern end of the island. His brother, Dr. J. T. Bottomley, has long been connected with Lord Kelvin in work at the University of Glasgow, and is also well known among Americans.

MR. C. B. BURLEIGH.—At the annual meeting of the National Association of Cotton Manufacturers, held April 24, at the Massachusetts Institute of Technology, the association medal was presented to Mr. Chas. B. Burleigh in acknowledgment of the merits of a paper read before the association at its fall meeting, Sept. 13, 1906, entitled "The Curtis Vertical Steam Turbine." The provision under which this medal was established at the annual meeting of the association in 1899 states that, "It is the purpose of the Board of Government that this medal may be given to any person whose work has been, in their opinion, an advantage of sufficient importance to the purposes to which this organization is devoted in its broadest sense, including any papers read before the association. The reasons governing any award shall be entered on the records of the board of government, and the medal will be accompanied

by a suitable diploma executed by the president and secretary, setting forth the award and the cause for which it was made."

LIEUT.-COL. GLASSFORD.—At a meeting of the Chamber of Commerce of Seattle on April 19, the work of Lieut-Col. William A. Glassford, Signal Corps, was unanimously endorsed by that body, and the following resolution was passed: "Whereas, It is announced that Lieut.-Col. W. A. Glassford, who for several years past has been in charge of the Government cable and telegraph service in this district, which embraces Alaska, has been promoted and transferred to Omaha, Neb., and, Whereas, during his administration the service of the cable and telegraph lines under his control has been signally efficient and satisfactory to the commercial interests of this community; Therefore, be it resolved by the Seattle Chamber of Commerce, while regretting that Lieut.-Col. Glassford's transfer to other and higher duties involves his leaving Seattle, that the business interests take this method of expressing their appreciation of his efficient administration of the signal service in this district, which is so closely identified with the business interests of Seattle, and of congratulating him upon his promotion."

MR. FRANCIS RAYMOND, of Chicago, the well-known manufacturer's agent, has given up his agency business to go with the Sheldon School of Scientific Salesmanship, to co-operate with the Co-Operative Electrical Development Association. This would appear to be a good field of effort at the present time when there is need for high-class salesmen in central stations, factories and the electrical trade generally, and it is the object of this school to produce and improve such salesmen. Mr. Raymond has taken much interest in scientific salesmanship as a profession for some time past and has been among the most successful electrical salesmen in the West. He was born in Detroit in 1870 and graduated from the Michigan Military Academy in 1886. He was for a time advertising and subscription solicitor for a newspaper published by a real estate company. In 1892 he graduated from Cornell University with the degree of M. E. and E. E., and took the General Electric Company's expert course at Lynn, Mass. In 1893 he left the General Electric Company, where he was a foreman of railway construction, to go with the Columbia Incandescent Lamp Company as salesman. He was with the American Electric Heating Corporation from 1896 to 1897; Gregory Electric Company, 1897 to 1899, and was Western sales manager for the General Incandescent Arc Light Company from 1899 to 1900. Since then he has been in business for himself in Chicago handling electrical specialties. He is a member of the A. I. E. E., Western Society of Engineers, Sons of Jove, Military Order of the Royal Legion, Chicago Athletic Association, and is a Mason. He is first vice-president of the Business Science Club and of the Electrical Salesmen's Association.

Trade Publications.

THE INDESTRUCTIBLE FIBRE COMPANY, Wendell & MacDuffie, 26 Cortlandt Street, New York, sole selling agents, has just issued a four-page pamphlet describing its materials for car headlinings and marine work. There are three grades of fibre board made up in various qualities for this class of work and are sold under the trade names of "Durite," "Fibrite" and "Kantlite."

CEMENT.—Among the many bulletins of interest to engineers and contractors doing underground work which have been issued by the American Conduit Company may be mentioned a recent one showing a chart by which the cost of cement per cubic yard of concrete, having various ratios of mixture and various prices of cement, may be quickly determined. These bulletins may be obtained upon application to the New York office of the company at 140 Nassau Street.

DESK AND WALL FANS.—Folder No. 4076 of the Westinghouse Electric & Manufacturing Company deals briefly with direct-current desk and wall fans. The folder is of envelope size and is used for insertion with any letter of a business nature that a person interested in the sale of fans may write to possible users of such equipment. The cover design, which is printed in well selected colors, is quite suggestive; it shows a business man seated at his office desk and being cooled by the breezes from an electric fan, while thoughts of the seacoast and its cooling waves pass through his mind.

"STANDARD" DIRECT-CURRENT FANS.—Consistent neatness is the keynote of the plan employed in the preparation if its electric fan catalogue by the Robbins & Meyers Company, Springfield, Ohio. The catalogue is printed in two colors, which blend harmoniously, and produce the impression that care has been exercised in designing not only the catalogue itself, but also the apparatus which it describes. A perusal of the pages showing the details of the fans and driving motors serves to indicate that all of the parts are well proportioned and the wearing parts well lubricated, so that the finished product possesses to a marked degree the appearance of symmetry of the parts and durability of the whole.

WESTERN ELECTRIC COMPANY, New York and Chicago, has recently been issuing some interesting pamphlets and data. One useful book deals with the installation and maintenance of dynamoelectric apparatus in telephone exchanges; and there are folders that discuss motors and motor drive. Some amazing details are given as to the capacity of the Western Electric manufacturing plants. In the Chicago plants alone there are 3000 motors in use driving 5000 machines which turn out 18,000 kinds of articles. During 1906, no less than 200,000 ft. of walnut lumber was used in making telephone sets; and 10,000,000 ft. of pine lumber for boxes and crates. Wire was insulated at the rate of 12 miles per minute, 4500 lbs. of silk a week was used as insulation, and 1,500,000 miniature flash lamps were made. The fan motor department has a capacity of 5000 per month.

CRUCIBLES.—A publication recently issued by the Joseph Dixon Crucible Company, Jersey City, N. J., entitled "Crucibles: Their Care and Use," partakes more of the nature of a discussion of a technical subject than of a catalogue of a company's product. The treatise was prepared by Mr. John A. Walker, general manager of the above company, for the purpose of instructing users of crucibles as to their proper use, and the dangers of abuse of crucibles. It tells what graphite is, and why crucibles are made of it. It tells why crucibles must be made of flake graphite. It tells why some crucibles are dark and others light, and the importance of that fact. The book fully describes the various fuels used in melting metals, and their effect on the crucibles. It speaks of the importance of perfect combustion. The book also carries much allied information. It gives the proportions of metal in commonly-used alloys. It tells the freezing, fusing and boiling points of various substances. It gives the specific gravity of various metals and other commodities. It gives the comparative value of fuels, and much other information of value in the foundry.

Business Notes.

ROSSITER-MACGOVERN.—On May 1 Rossiter-MacGovern Company removed its offices to the West Street Building, 90 West Street, New York City.

NOVELTY LAMPS.—The Novelty Incandescent Lamp Company, Emporium, Pa., advises us that the product of its refilled lamp factory will hereafter be known as the "XL" refilled incandescent lamp.

ERNER & HOPKINS COMPANY, of Columbus, O., has been appointed agent for the state of Ohio by the Blake Signal & Manufacturing Company, Boston, Mass., for the sale of the Blake tube flux.

DIEHL MANUFACTURING COMPANY, of Elizabethport, N. J., has opened an office for its dynamos, motors and electric fans, etc., at 217 North Calvert Street, Baltimore, Md., with Mr. H. A. Thomas as manager.

BOLTON & MAREAN.—Mr. H. S. Bolton and Mr. G. B. Marean, under the above firm name, have opened an office as consulting electrical and mechanical engineers at 12 Independencia 1A, Mexico, D. F., and propose to undertake all classes of work falling in their field.

REMOVAL NOTICE.—The San Francisco office of the General Electric Company is now permanently located in the Union Trust Building in San Francisco. Since the fire the office has been located in the Union Savings Bank Building at Oakland, large temporary warehouses having also been erected in the same city.

LAMP AGENCY.—A business man of Holland advises U. S. Consul Hill that he desires to enter into correspondence with manufacturers of highly economical electrical incandescent lamps with a view of taking the agency for the Netherlands. Details can be obtained as to his address, etc., from the Bureau of Manufacturers, Washington.

THE BIDWELL ELECTRIC COMPANY has closed a contract with the Chicago Heights Land Association for the removal and location of its works to Chicago Heights, Ill. The present plant of the company is located at 133 to 139 Clinton Street, Chicago, Ill. The company manufactures electric motors, generators and a general line of electrical supplies and appliances.

A. D. GRANGER COMPANY announces the change in its New York office to rooms 1518-19-20 West Street Building, 90 West Street, corner of Cedar, where it has much larger and more commodious offices arranged for the better conduct of its business. The company handles the products of the Skinner Engine Company, of Erie; Oswego Boiler & Engine Company, Harrisburg Manufacturing & Boiler Company, Union Iron Works, of Erie; Bates Machine Company, of Joliet; Frost Manufacturing Company, of Galesburg, Ill.

BLAKE TUBE FLUX.—Mr. A. B. Smith, of the department of telephone engineering at Purdue University, Lafayette, Ind., has written to the Blake Signal & Manufacturing Company, Boston, as follows: "We have been using the sample of your tube flux in the telephone laboratory and have found it very convenient. Your idea of placing the compound in this form is certainly to be commended. We are daily doing more or less soldering, and the ordinary stick of flux does not last long, due to waste. You have made a decided advance." Mr. Smith has had a long experience in telephonic work and appliances.

HOWES & MORSE.—Messrs. Edward Townsend Howes and Henry Grant Morse, architects, announce that they have formed a partnership under the firm name of Howes & Morse, and will open their offices at 19 West Thirty-Eighth Street, New York City, on May 1. Mr. Morse has become widely and most favorably known among engineers by his admirable work and efficient services in connection with the construction of the new Engineering Societies Building, of which he was associate architect. His circle of appreciative friends among the engineers is, moreover, not lessened by the fact that he is a member of the house committee of the Engineers' Club, which already has a quite strong contingent of architects. Mr. Howes, his partner, is a rising young architect, whose professional work and skill as an artist are becoming widely known.

NILES-BEMENT-POND COMPANY.—On May 1 the Chicago branch

of Niles-Bement-Pond Company, the largest manufacturer of machine tools in the world, will occupy its new offices on the sixth floor of the new Commercial National Bank Building, Clark and Adams Streets, Chicago. In this building will also be located many of the large engineering and steel companies. Pratt & Whitney Company will abandon its show room and offices at 46-48 South Canal Street, and will combine its machinery sales department with that of the Niles-Bement-Pond Company. The show room and stock of Pratt & Whitney, small tools, and the small tools sales department, will be located on the ground floor of the new Plamondon Building, Clinton and Monroe Streets, where a complete line of Pratt & Whitney small tools and gauges will be carried in stock. Mr. George F. Mills, who has for several years looked after the interests of these companies in the Chicago territory, will continue as manager of the Chicago offices.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

(Published first issue of each month.)

American Electro-Therapeutical Association. Secretary, Dr. C. E. Skinner, New Haven, Conn.

American Electrochemical Society. Secretary, S. S. Sadtler, 59 S. 10th St., Philadelphia. Next meeting Philadelphia, May 2, 3 and 4, 1907.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, United Engineering Societies' Building, 29 West 39th St., New York. Meetings, fourth Friday of each month. Annual meeting, Niagara Falls, N. Y., June 24, 1907.

American Street and Interurban Railway Engineering Association. Secretary, Walter S. Mower, London Ont.

American Society of Mechanical Engineers. Secretary, Calvin W. Rice, United Engineering Societies' Building, 29 West 39th St., New York. Spring meeting, Indianapolis, Ind., May 28-31, 1907.

American Society of Municipal Improvements. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y. Next meeting, Detroit, Mich., third Wednesday, September, 1907.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, United Engineering Societies' Building, 29 West 39th St., New York. Next meeting, Atlantic City, N. J., October 14-18, 1907.

Association of Edison Illuminating Companies. Secretary, George R. Stetson, New Bedford, Mass.

Association of Electric Lighting Engineers of New England. Secretary, Wells E. Holmes, 308 Washington St., Newton, Mass. Annual meetings held in Boston, third Wednesday in March.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, Milwaukee, Wis. Next meeting, Atlantic City, N. J., June 19, 1907.

California Independent Telephone Association. Secretary, P. T. Whittier, Spencer, Cal.

Canadian Electrical Association. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont. Next meeting, Montreal, September, 1907.

Canadian Street Railway Association. Secretary, Allan H. Royce, 48 King St. W., Toronto, Ont.

Central Electric Railway Association. Secretary, W. F. Mulholland, Indianapolis, Ind.

Colorado Electric Light, Power & Railway Association. Secretary, John F. Dostal, 405 17th St., Denver, Col. Next meeting, September, 1907.

Electric Club of Cleveland. Secretary, Geo. L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

Electrical Contractors' Association of New York State. Secretary, John P. Faure, 77 Water St., Ossining, N. Y.

Electrical Contractors' Association of State of Missouri. Secretary, Chas. J. Sutter, 1220 Pine St., St. Louis, Mo.

Electrical Salesmen's Association. Secretary, Francis Raymond, 1537 Old Colony Building, Chicago.

Electrical Trades Association of Canada. Secretary, Wm. R. Stavely, Royal Insurance Building, Montreal, Can.

Electrical Trades Association of Chicago. Secretary, Frederick P. Vose, Marquette Building, Chicago. Next meeting, Chicago, November 7, 1907.

Electrical Trades Association of Philadelphia. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursdays each month.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliot, Claus Spreckles Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Friday of each month.

Empire State Gas and Electrical Association. Secretary, Charles H. B. Chapin, 154 Nassau St., New York. Next meeting, October, 1907.

Engine Builders' Association of the United States. Secretary, J. I. Lyle, 39 Cortlandt St., New York.

Illinois State Electrical Association. Secretary, H. E. Chubbuck, La Salle, Ill.

Illuminating Engineering Society. Secretary, Dr. Arthur H. Elliot, 4 Irving Place, New York. Meetings in New York, second Friday of each month.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

International Association of Municipal Electricians. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Norfolk, Va.

International Independent Telephone Association. President, Jas. B. Hoge, Electric Building, Cleveland, O. Next meeting, Chicago, June 4, 5 and 6, 1907.

Iowa Electrical Association. Secretary, L. B. Spinney, Iowa State College, Ames, Ia.

Iowa Independent Telephone Association. Secretary, C. C. Deering, Boone. Ia. Next meeting, Cedar Rapids, Ia., second Tuesday, March, 1908.

Iowa Street and Interurban Association. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Clinton, Ia., May, 1907.

Kansas Gas, Water & Electric Light Association. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Topeka, Kan., Oct. 16, 1907.

Kentucky Independent Telephone Association. Secretary, James Maret, Mount Vernon, Ky. Regular meeting, second Tuesday in October each year.

Massachusetts Street Railway Association. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

Michigan Electrical Association. Secretary, A. C. Marshall, Port Huron, Mich. Next meeting, Battle Creek, Mich., August 21-23, 1907.

Missouri Independent Telephone Association. Secretary, Houck McHenry, Jefferson City, Mo. Next meeting, Kansas City, Mo., May 8 and 9, 1907.

National Arm, Pin & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National Electric Light Association. Secretary, W. C. L. Eglin, Philadelphia, Pa. Next meeting, Washington, D. C., June 4, 5, 6 and 7, 1907.

National Electrical Contractors' Association of the United States. Secretary, W. H. Morton, 94 Genesee St., Utica, N. Y. Next meeting, New York City, July 17, 18 and 19, 1907.

National Electrical Trades Association. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago. Next annual meeting, Chicago, second Thursday in June, 1907.

National Interstate Telephone Association. Secretary, A. L. Tetu, Nashville, Tenn.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New York Electrical Society. Secretary, G. H. Guy, 114 Liberty St., New York.

New York State Independent Telephone Association. Secretary, R. M. Eaton, Niagara Falls, N. Y. Next meeting, Syracuse, N. Y., June, 1907.

Northwestern Electrical Association. Secretary, Roger N. Kimball, Kenosha, Wis. Next meeting, Milwaukee, January, 1908.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, O. Next meeting, Toledo, Aug. 20 and 22, 1907.

Ohio Independent Telephone Association. Secretary, Ralph Reamer, Portsmouth, Ohio.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, F. W. Ballard, 104 Canal St., Cleveland, O. Next meeting, Dayton, O., May 17 and 18, 1907.

Oklahoma Electric Light, Railway & Gas Association. Secretary, Charles W. Ford, Oklahoma City, Okla.

Old Time Telegraphers and Historical Association. Secretary, John Brant, 195 Broadway, New York. Next meeting, Niagara Falls, N. Y., 1907.

Pacific Coast Electrical Transmission Association. Secretary, Samuel G. Reed, Portland, Ore.

Pennsylvania State Independent Telephone Association. Secretary, H. E. Bradley, 136 South Second St., Philadelphia, Pa.

Pike's Peak Polytechnic Society. Secretary, E. A. Sawyer, Colorado Springs, Col. Meeting second Saturday of each month.

Public Utilities Association of Indiana. Secretary, J. A. Shunk, Peru, Ind. Regular meetings second Thursday in May and December.

South Dakota Telephone Association. Secretary, E. R. Buck, Hudson, S. D.

Southwestern Electrical & Gas Association. Secretary, R. B. Stichter, Dallas, Tex. Next meeting, San Antonio, Tex., May 14 and 16, 1907.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Secretary, E. M. White, Box 345, Hartford, Conn.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, Canandaigua, N. Y.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W. Buzzell, St. Johnsbury, Vt.

VIRGINIA INDEPENDENT TELEPHONE ASSOCIATION. Next meeting, Norfolk, Va., May 21, 1907.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary, Electrical Committee, C. M. Goddard, 55 Kilby St., Boston, Mass. Next meeting, March, 1908.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Wednesday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED APRIL 23, 1907.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

850,904. ELECTRIC CURLING IRON; Jacob L. Burgard, Chicago, Ill. App. filed April 5, 1906. A curling iron of substantially the ordinary form, except that both bars are made with resistance elements embedded therein. The circuit connections extend outward through the respective handles.

850,910. POLICE PATROL BOX; George V. Doherty, Boston, Mass. App. filed Aug. 4, 1906. The form of police box or alarm having a pair of handcuffs chained to reels within the box.

850,912. PROCESS OF MAKING ARTICLES BY ELECTROPLATING; Thomas A. Edison, Llewellyn Park, Orange, N. J. App. filed Oct. 5, 1903. The process of making a storage battery can or receptacle, which consists in coating a film of copper on a former of suitable shape, in plating a film of iron on the copper coating, and in removing the copper film, substantially as set forth.

850,913. SECONDARY BATTERY; Thomas A. Edison, Llewellyn Park, Orange, N. J. App. filed Dec. 7, 1905. In a storage battery, the combination with a can and electrodes mounted therein, of an escape-tube in the top of said can, a valve in said tube, a casing carried by the escape-tube and a dash-plate in said casing, substantially as set forth.

850,917. SPACE TELEGRAPHY; Lee DeForest, New York, N. Y. App. filed Jan. 29, 1907. Relates to the transmitting systems of a wireless telegraph installation and includes a condenser and means for producing an electric arc to produce the high frequency vibratory currents. The patent covers maintaining an atmosphere of steam about the electric arc to increase the efficiency thereof.

850,924. ELECTRIC HEATER; Edward E. Gold, New York, N. Y. App. filed May 4, 1906. Details of construction of heating apparatus adapted for electric trains. One form of the invention has porcelain and metal parts adapted to be assembled into a cylindrical form beneath the car seats.

850,926. ELECTRIC MOTOR; John B. Gury, St. Louis, Mo. App. filed July 16, 1906. Relates to features of construction of an electric motor having a pinion on the armature shaft with a ratchet connection and a manually operated slidable bar whereby the armature is rotated by movement of said slidable bar in one direction. Constitutes a motor starter.

850,937. AUTOMATIC CONTROL SYSTEM FOR ELEVATORS, Etc.; Benjamin N. Jones, East Orange, N. J. App. filed Apr. 29, 1903. Relates to the control of elevators. Provides resistance regulating means whereby sections may be successively cut out of the motor circuit and also has a so-called "time interval magnet" which determines the rate at which the resistance regulating means shall operate.

850,944. ELECTROPLATING SOLUTION; Richard H. Marshall, Scottdale, Pa. App. filed Oct. 18, 1906. A solution for electroplating containing silver and a metal of the nickel group, each of said metals being present in the solution in a quantity in excess of any other metal than the metals mentioned.

850,947. CONTROLLING DEVICE FOR ELECTRIC MOTORS FOR DRIVING SEWING MACHINES, SMALL LATHES, Etc.; Albert H. Midgley and Benjamin Reed, London, England. App. filed Jan. 31, 1906. A form of controller having a single arm movable over contacts to control the resistance in the armature circuit, said arm simultaneously operating to change the resistance in the field circuit.

850,972. WIRELESS RECEIVING APPARATUS FOR EXPLODING MINES; Ferdinand Schneider, Langenfeld, Germany. App. filed Jan. 3, 1906. Buoys are anchored in the water at the desired location and have small antennæ projecting therefrom from which circuits are led to a special construction of wave detector within the torpedo.

851,003. ELECTRIC ARC LAMP; Otto Gross, Longsight, Manchester, England. App. filed Dec. 20, 1904. Arc lamp of the type having carbons fed downward in converging relation. The carbons are fed in tubes which constitute magazines so as to automatically supply new carbons when any pair is exhausted.

851,009. ARC LAMP HANGER OR SUPPORT; James E. Joyce, Hoboken, N. J. App. filed Nov. 25, 1905. A block or arm is suspended by a strap and the arc lamp is hung from the arm between the blades of the strap by a specially constructed insulator which permits the lamp to hang symmetrically from the arm or beam.

851,024. FIXTURE FOR ELECTRIC LAMPS; James B. McGinley, Allegheny, Pa. App. filed Feb. 19, 1906. Lamp receptacle of the molding type adapted to be placed on a wall. Is designed, however, to co-operate with a specially constructed metallic molding of circular section and which constitutes virtually a conduit pipe, except that it is interrupted at each lamp recepacle.

851,027. SPARK COIL; Charles P. L. Noxon, Syracuse, N. Y. App. filed Feb. 5, 1906. Has a small magnet which can be thrown into the primary circuit of an induction coil to assist the action of the usual core upon the armature.

851,029. TROLLEY RETRIEVER; Simeon F. Pierce, St. Paul, Minn. App. filed Oct. 30, 1905. The trolley pole is normally held raised by a spring which is kept tensioned by pneumatic cylinder. A dash pot device causes a valve to relieve the air pressure in case of an abrupt upward movement of the pole.

851,031. ELECTRICAL IMPULSE COUNTING SWITCH; Homer J. Roberts, Evanston, Ill. App. filed Nov. 4, 1905. Relates to a telephone switch for use with selective party line telephone systems. Provides means by which a given number of impulses may be thrown upon a circuit and the sending of any further impulses prevented or interrupted at the end of the predetermined series.

851,032. ELECTRIC FUSE; Ulysses G. Rogers, Columbus, O. App. filed May 17, 1906. The fuse wire is led through a sheet of insulating material bent into zig-zag form so as to prevent the formation of an arc when the fuse melts.

851,046. MAGNETIC ORE SEPARATOR; Henry H. Wait, Chicago, Ill. App. filed March 20, 1905. A revolving drum is inductively magnetized and rotates in water through which the stream of ore particles is fed. The magnetic particles are displaced into a separate chute by the rotation of the drum.

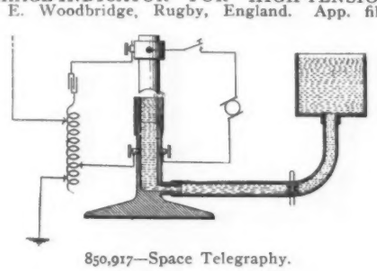
851,051. HEAT-COIL; Arthur H. Adams, New York, N. Y. App. filed Oct. 9, 1905. In a protector for electrical circuits, a heat-coil having a slidable pin adapted to project from either end thereof, of a cap slidably engaging said heat-coil to bear against said pin, said heat-coil being reversible in said cap.

851,071. AUTOMATIC TELEGRAPHY; Albert C. Crehore, Tarrytown, N. Y. App. filed July 12, 1902. The improvement in methods of telegraphing by an alternating current generator, consisting in producing prolonged spacing by sending a succession of semicycles of one polarity and omitting intermediate semicycles of the opposite polarity, as and for the purpose described.

851,086. DOOR CONTROLLED ELECTRIC ELEVATOR SYSTEM; Richard H. Gay, Conesville, Ia. App. filed June 29, 1906. A system of automatic door control for electric elevators designed to avoid the complicated wiring incident to the use of "master switches" and independent circuits and batteries associated with the door control switches.

851,090. TELEPHONE-METER; Newman H. Holland, Brookline, Mass. App. filed June 8, 1903. The combination with the actuating pawl and its operating member; of a controlling device for said pawl; a locking member for said controlling device; an electromagnet co-operating with said looking member; a circuit for said electromagnet, and an automatic switch in said circuit operated by said controlling device, as set forth.

851,149. LEAKAGE-INDICATOR FOR HIGH-TENSION LINES; Jonathan E. Woodbridge, Rugby, England. App. filed Nov. 21, 1904. The combination of a normally grounded transmission system, and means inductively related to the system for indicating leakage from said system to ground.



850,917—Space Telegraphy.

851,156. GALVANOMETER; Joseph Broich, Brooklyn, N. Y. App. filed June 27, 1906. Relates to construction of D'Arsonval galvanometer in which the movable element is suspended by a silk fiber in use. The present invention relates to a means for rigidly grasping and holding the movable element when not in use so as to prevent injury to the fiber.

851,157. ELECTRIC FUSE OR CUT-OUT; Leonard B. Buchanan, Woburn, Mass. App. filed May 28, 1906. Construction of fuse having a disk in the casing which is normally held against displacement by a spring connection with the fuse wire. When the fuse wire melts the disk is displaced to indicate the fact.

851,174. TELAUTOGRAPH; Arthur Korn, Munich, Germany. App. filed Jan. 25, 1907. Designed to increase the speed in the production at the receiving station of a copy of an original at a sending station. Has a galvanometer at the receiving station with an intercepter on one of two parallel metallic springs as conductors for controlling a ray of light acting upon a sensitized film.

851,175. DUMB WAITER AND ELEVATOR; Louis E. Laurent, Trenton, N. J. App. filed May 18, 1905. Combined motor hoisting drum and controller adapted for small installations such as dumb waiters. Relates to circuits and mechanical details of construction.

851,190. BURGLAR ALARM; Charles L. Wilkins, Columbus, O. App. filed Mar. 15, 1906. A burglar alarm of the type having a pointer or index which moves over a dial to indicate the particular location at which an alarm is given. A weight impelled drum is released to move until arrested by one or another of a series of magnetically impelled detents.

851,218. CIGAR LIGHTER; Charles E. Bessel, Jersey City, N. J. App. filed Mar. 16, 1906. A box of insulating material has a flat plate or surface in which is inset a series of spiral resistance elements which are laid slightly below the surface of the supporting plate.

851,222. INSULATOR CLAMP; Walter G. Clark, Seattle, Wash. App. filed Sept. 2, 1905. A clamp for fastening conductors upon insulators of the petticoated type adapted for high tension transmission. Includes metallic stampings, sheet metal straps and bolts by which they are assembled on the usual knob of the insulator.

851,239. CONTROLLING DEVICE FOR ELECTRIC MOTORS; John D. Ihlder, Yonkers, N. Y. App. filed Sept. 27, 1904. Means brought into operation automatically when the motor attains an

undue or excessive speed for impeding, retarding or stopping the motor. Includes generator windings adapted to act as a magnetic brake.

851,266. LINE-SELECTOR OF INTERCOMMUNICATION TELEPHONE APPARATUS; Franz Walloch, Berlin, Germany. App. filed Nov. 22, 1904. Has an arm swinging from a series of contacts and actuated to pass thereover without touching the same except when the telephone receiver is removed from the hook.

851,291. STARTING DEVICE FOR HOISTING MACHINES; John D. Ihlder, Yonkers, N. Y. App. filed July 23, 1904. Relates to starting devices for motors, especially those applied to hoisting apparatus where there is more or less slack cable to be wound up before the actual load is applied. Provides an easy starting of the machine and prevents it from unduly accelerating at the initial stages.

851,336. TRANSMITTER FOR WIRELESS TELEGRAPHY; Georg Von Arco, Berlin, Germany. App. filed June 27, 1905. Means for tuning a transmitter comprising a detector responsive to current intensities and means for connecting and disconnecting the detector with the transmitter and its tuning means, and a sparking device for the transmitter.

851,353. PRIMARY BATTERY; Charles E. Hite, Burlington, N. J. App. filed May 17, 1906. In a primary battery, the combination of a receptacle, a single film of insoluble non-conducting material forming a partition dividing the receptacle into cells and an electrode supporting said partition.

851,355. TELEPHONE-TRANSMITTER; Stephen C. Houghton, Rome, N. Y. App. filed March 7, 1907. A telephone-transmitter having a face-plate having an inwardly extending groove provided with perforations, substantially as described.

851,362. SIGNAL APPARATUS; Ernest De Malan, London, England. App. filed Dec. 5, 1906. Relates to a railway switch and signal apparatus in which the switches and signals are operated by electric motors. Provides means for preventing the closure of the circuits through the motors when abnormal conditions exist.

851,375. SUPPORT FOR ELECTRIC CABLES; George G. Raymond, New Rochelle, N. Y. App. filed Dec. 22, 1904. A casting is formed to be riveted or bolted to upright channel irons upon the supporting wall or surface. The casting has grooves to receive the cables.

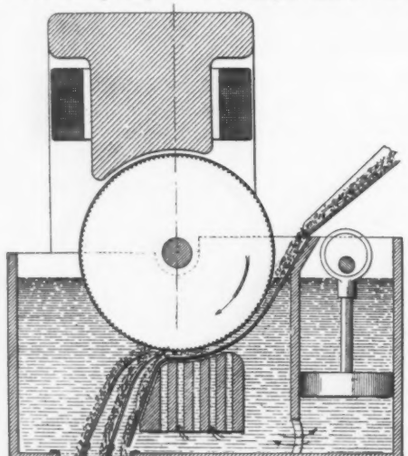
851,392. LIGHTNING ARRESTER; Alton W. Ball and Mark T. Seymour, Srow, N. Y. App. filed Oct. 24, 1904. Lightning arrester having the sparking points at the end of delicate spring blades which separate in case an arc is formed between them due to lightning discharge, so as to break the arc as quickly as possible.

851,402. DRY BATTERY; Samuel Cochrane, Jersey City, N. J. App. filed Jan. 19, 1906. A liquid tight battery cell or cup made of a fibrous material, saturated on its outer side only and to an appreciable depth with a non-absorbent insulating compound, the inner side being left absorbent.

851,403. ELECTRIC LIGHTING DEVICE; Antone M. Cornelius, Chicago, Ill., and Willoughby V. Champlin, Rochester, N. Y. App. filed Jan. 12, 1907. A lighter in the form of a cylindrical handle having an end plate or surface with a spiral resistance element which is protected by a perforated plate overlying the same.

851,410. ELECTROTHERMAL SWITCH; John Erickson, Chicago, Ill. App. filed Oct. 21, 1904. Details of construction of a thermal cut-out for telephone use having spring blade contacts and a rotary self soldering actuated device for maintaining them in contact.

851,415. TROLLEY; Charles Y. Haile, Uniontown, Pa. App. filed June 26, 1906. The trolley harp has rods hinged thereto and spring impelled upward therefrom which guide the wheel on the wire but yield downwardly in passing hangers, etc.



851,046—Magnetic Ore Separator.

851,420. ELECTROTHERMAL SWITCH; Richard B. Hewett and James G. Nolen, Chicago, Ill. App. filed June 5, 1903. An electrothermal switch comprising a flexible metallic diaphragm, a casting enclosing said diaphragm, there being a confined body of air at one side of said diaphragm, a high resistance associated with said confined body of air, and circuit-controlling contacts mounted at opposite sides of and opened and closed by said diaphragm.

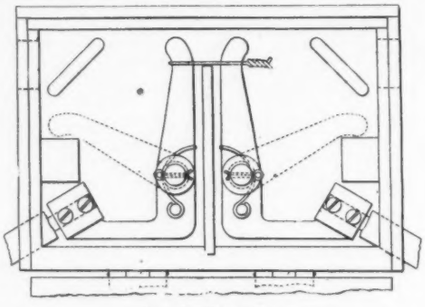
851,440. ELECTRICAL HEATING ELEMENT OR RESISTANCE; Edward G. Rivers, Richmond, England. App. filed June 11, 1906. A flat plate of clay is grooved on one face in a zig-zag direction. Has silicated carbon within the groove and which adheres to the surface of the clay plate.

851,446. INSULATED COUPLING; Samuel N. Shields, Greensburg, Pa. App. filed July 30, 1906. A block of insulating material is grooved and perforated in two planes transverse to one another so as to receive links or straps joined to the line wires to be connected.

851,458. PARTY-LINE TELEPHONE SYSTEM; Felton Vollmer, Winstead, Minn. App. filed Nov. 22, 1906. In a party-line telephone system, the combination of a revoluble shaft, contact mechanism to be opened and closed thereby, a talking circuit to be completed and broken by movements of said contact mechanism, a train of clock-work, mechanism controllable by said train of clock-work for releasing said revoluble shaft, and means for turning said revoluble shaft.

851,461. VOLTAGE REGULATOR FOR SERIES WOUND ELECTRIC GENERATORS; James W. Welch, Edgewood Park, Pa. App. filed Oct. 1, 1906. A form of circuit breaker or controller together with diagram of electric circuits by which it operates to maintain the electromotive force at a constant value notwithstanding changes in speed of the generator.

851,467. MEANS FOR PREVENTING SPARKING; Frank W. Wood, Newport News, Va. App. filed Jan. 2, 1907. In order to prevent the inductive sparking which takes place when the circuit of an electromagnet is opened, patentee has a special winding including different numbers of turns and which are connected in multiple to the energizing circuit.



851,560—Fuse Box.

851,492. COMBINED LIGHTNING-ARRESTER, FUSE-BOX, AND INSULATOR; Russell R. Burrin and Theodore F. Gaebler, Rockville, Ind. App. filed Jan. 26, 1906. A device of the class described, consisting of a fuse box having a chamber formed therein adapted to receive fuses and having projecting arms at the extremities thereof having insulators for attaching electric conductors, means for attaching said device to a support, and binding posts for connecting wires, and fuses in said chamber.

851,500. TELEPHONE TRUNKING SYSTEM; William W. Dean, Chicago, Ill. App. filed July 12, 1902. Relates to a complete diagram of circuits for trunking exchange system having A boards and B boards.

851,506. ELECTRIC FIRE ALARM; William H. H. Everett, Newton Falls, O. App. filed Sept. 22, 1904. Has contact points spring impelled into circuit closing relation and a thermometer, the bulb of which resists movement of such spring. In case of excessive temperature the bulb breaks and the circuit is closed.

851,523. AUTOMATIC BLOCK SIGNAL; Newton C. Keeling, Bridgeport, Conn. App. filed Oct. 31, 1906. Block signal of the type adapted to single track trolley roads having an overhead trolley. Star shaped devices are mechanically impelled to rotate by the engagement of the trolley wheel in passing, and these control the signal circuits.

851,552. KICK BOARD; William H. Nicolay, New York, N. Y. App. filed Oct. 26, 1906. Relates to protecting circuit wires in a building at the point where they pass through the floors thereof. Has a cast iron hopper-shaped part which fits around the face of the molding.

851,560. FUSE BOX; Charles Remelius, Newark, N. J. App. filed Feb. 6, 1907. The fuse wire is looped around two bell crank levers which are spring impelled apart within their box or casing. A partition separates the levers except at their extremities so that the arcing distance is increased by their separation.

851,577. CROSS ARM PIN; David Weaver, Paterson, N. J. App. filed July 7, 1906. A drop threaded metallic pin having a shoulder and rods or lugs directly beneath the same whereby the pin is firmly anchored in the cross arms and rendered incapable of turning.

851,581. MOTOR EXTENSION RECEPTACLE; Gustav Willius, Jr., St. Paul, Minn. App. filed June 23, 1905. Relates to electrical connector plugs and sockets or receptacles therefor, for use in coupling electric devices of portable or semi-portable nature to fixed conductors or bus-bars. Is really a plug and jack within a special fireproof portable casing.

851,597. OUTLET BOX; Louie T. LaPaugh, Utica, N. Y. App. filed Feb. 7, 1906. An outlet box stamped of sheet metal and having a cover which is secured to the body of the box by lugs on the box having dowel or cotter pins. The box has the usual weakened knock-out portions.

851,598. OUTLET BOX; Louie T. LaPaugh, Utica, N. Y. App. filed Feb. 7, 1906. Relates to modifications of the above.

851,621. WIRELESS SIGNALING SYSTEM; Simon Eisenstein, Berlin, Germany. App. filed July 3, 1906. Relates to the transmission device of a wireless system whereby a very sharp resonance or selectivity is obtained and any listening with a telephone is rendered difficult. The spark gap is contained not in secondary circuits of the aerial conductor but in the aerial conductor itself.

851,632. MOTOR; Paul Synnestvedt, Pittsburg, Pa. App. filed May 7, 1904. Variable speed motor adapted for use with automobiles. The fields are sectionally wound and connected in a special way with the contacts of a circuit controller. In this way the windings are connected in series and series multiple to secure four speed variations.

851,633. ELECTRIC CONTROL MECHANISM; Paul Synnestvedt, Pittsburg, Pa. App. filed Aug. 30, 1904. Relates to modifications of the above.

12,640. BRANCH BOX FOR INSULATED ELECTRIC WIRES; Morton Havens, Jr., Albany, N. Y. App. filed Nov. 16, 1905. Provides a metallic tubular conduit and a box having an oblong branch which communicates with the conduit for the passage of the circuit wires in either direction toward or from the same.

12,642. SPRING TERMINAL CLIP; John Schade, Jr., Brooklyn, N. Y. App. filed March 11, 1907. U-shaped spring clip has a loop on one of its arms engaging a pinion in the other arm so as to clamp upon a circuit wire inserted through said loop.